INST.No.INE-271J

CHINO

AH3000 SERIES (MULTI-POINT TYPE)

HYBRID RECORDER

INSTRUCTIONS

CHINO

■ PREFACE Requests and notices

Thank you for your purchase of AH 3000 series hybrid recorder (multi-point type) having a 180mm recording width. Please read this instruction manual without fail for using this instrument correctly and safely and also preventing troubles in advance.

Separate Instruction Manuals

This instruction manual describes the operation of the options consisting of ① alarm output, remote contacts and ② printing format, high-speed trace printing as well as the operation of standard specifications. When the instrument is provided with the communications interface (option), the instruction manual for communications interface is attached as a separate manual. For other options, their instruction manuals are attached respectively. Please read these instruction manuals together with this manual.

1. Request to designers, instrument controllers, and sale agents

Deliver this instruction manual to the operator of this instrument without fail.

2. Request to the operator of this instrument

This instruction manual is necessary for maintenance, too. Keep this manual with due care until the instrument is discarded.

Notices

1. No part of this manual can be reproduced in any form, without permission.
2. For the contents of this manual, alteration is reserved without notice in the future.
3. This manual has been prepared by making assurance doubly sure about its contents. However, if any question arises or if any error, an omission, or other deficiencies were found, please inform your nearest CHINO's sales agent of them.
4. You are requested to understand that CHINO is not responsible for any operation results.

CONTENTS

Read the Following Instructions Without Fail

Introduction

Preparation

Basic Operation

Programming

Operations and Functions

Other Programmable Parameters/Functions

Options

Maintenance Functions

Maintenance

Remarks

The items marked with ⚠ in titles contain ⚠ **Warning** and ⚠ **Caution** .
Read these items without fail.

⚠ FOR SAFE USE

1. Preconditions for Use

This instrument is designed for mounting on an indoor instrumentation panel for use. (except for portable type)

International safety standards …….Out of those having an alarm output (option), the mechanical relay 'c' contact output specifications only does not conform.

・IEC standard : Conforms to safety class I (with PROTECTIVE CONDUCTOR TERMINAL) and IEC1010-1 (OVERVOLTAGE CATEGORY Ⅱ, POLLUTION DEGREE 2)
Conforms to the enclosure protective degree IEC529 (IP54) (Front part).
・CE marking (EC Directive):
EMC : Conforms to EN55011 group 1 Class A, EN50082-2 (Industrial environment)
Safety : Conforms to EN61010-1 +A2
・UL standard : UL3111-1 approved
・CSA standard (C-UL) : CSA C22.2 No. 1010 Approved

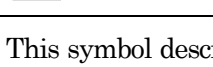
2. Labels Employed

The following labels are used for safe use.

Label	Name	Meaning
	Alert symbol mark	Caution on handling to prevent from an electric shock accident, injuries, and other accidents.
	Protective conductor terminal	Terminal connected to the protective conductor of power supply equipment for preventing an electric shock accident.

3. Symbols in This Manual

The cautions to be observed for preventing the damage of this instrument and unexpected accidents are sorted by the following symbols according to their importance degrees for enabling operators to use this instrument safely.

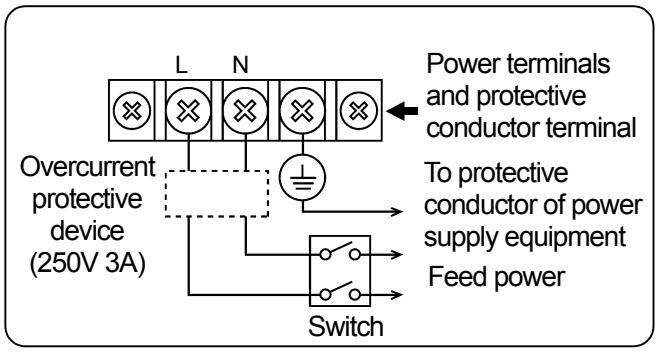
Symbols	Ranges of cautions
	This symbol is described in the titles (items) where  or  is explained.
	This symbol describes the cautions for avoiding the possibilities when the user is in danger of causing serious injuries or death due to an electric shock accident or other accidents.
	This symbol describes the cautions for avoiding the possibilities when the user is in a danger of causing slight injuries or this instrument or peripheral units may be damaged.
Remarks	This symbol shows a caution when this instrument does not function as spedified or when such a possibility exists.
Reference	This reference serves as a supplement for handling and operation, and it may be convenient for users.

⚠ WARNINGS

This paragraph covers important warning for safety to be observed before reading the instructions.
Fully understand the following warnings before reading this manual.
These warnings are important for preventing the danger to human bodies as well as accidents.

1. Switch and overcurrent protective device

This instrument is not provided with any power switch and any replaceable overcurrent protective device. Mount a switch and an overcurrent protective device (breaker, circuit protector or the like) for the power supply within 3m where the operator can reach them handily. Use these switch and overcurrent protective device conforming to IEC947-1 and IEC947-3.



2. Connect the instrument to the ground without fail.

Connect the protective conductor terminals of this instrument to the protective conductor of the power supply equipment. Don't disconnect them during use for the purpose of preventing an electric shock accident.

Reference Fuse in power supply unit

The following fuse is mounted in the power supply unit of this instrument for safety use. However, this fuse is not replaceable.

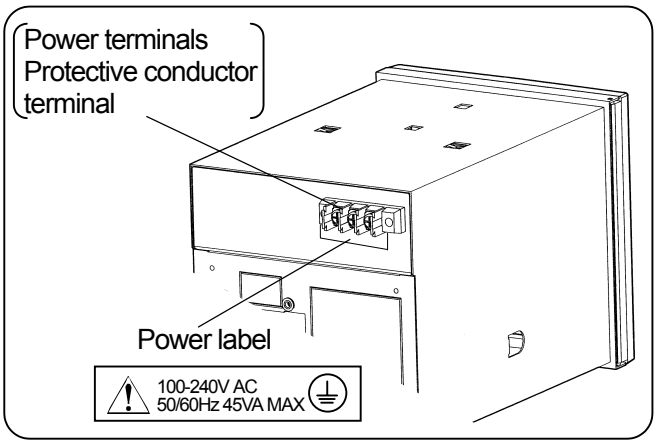
Manufacturer	Model	Ratings
SCHURTER	SPT001.2508	250V AC 2.5A
LITTEL FUSE	21502.5	
WICKMANN	19181	
LITTEL FUSE	215002P	250V AC 2A

3. Before turning on the power supply first

Make sure that the feed voltage is within the range indicated on the power label for safety before turning on the external power switch.

4. Don't repair or modify the instrument.

Don't repair or modify the instrument by replacing parts by any persons other than servicemen approved by our company, otherwise the instrument may be damaged or the instrument does not function normally, and also, accidents like an electric shock accident may occur.
The internal unit and case are provided with electric circuits and moving parts.
Don't put your hands, etc. into them, otherwise an electric shock accident or injuries may result.



5. Use the instrument according to the instruction manual.

Use the instrument correctly and safely according to this instruction manual.
You should understand that we are not responsible for any injuries, damage, lost profits, and any other demands which may be caused by wrong uses.

6. Stop feeding power supply, if an abnormal symptom occurs.

If abnormal odor, noises, or smoke occurs, or if the instrument is hot to such an extent as it cannot touch by hand, a dangerous trouble may occur. Turn off the power supply at once, and inform CHINO's sales agent of it.

■ MAJOR FEATURES AND FUNCTIONS

This instrument can record temperature and other various industrial variables on a 180mm chart in 6 , 12 or 24 channels.
①Trace printing by dots
②Digital printing to print measured values and other data

1. Features

Major features are shown below.
・Universal input. A range can optionally be selected every channel out of 10 DC voltage ranges, 36 thermocouple ranges, and 11 resistance thermometer ranges.
・Universal power supply. The working voltage range is 100 to 24OVAC, 50/60Hz.
・Conforms to international safety standards. Conforms to CE marking or approved and UL and CSA (C-UL) approved.
・The basic operation is done after programming range numbers and trace printing range.
・All operations can be done on the front keyboard without any need of drawing out the internal unit. The internal unit cannot be drawn out.

2. Functions

Major functions are shown below.

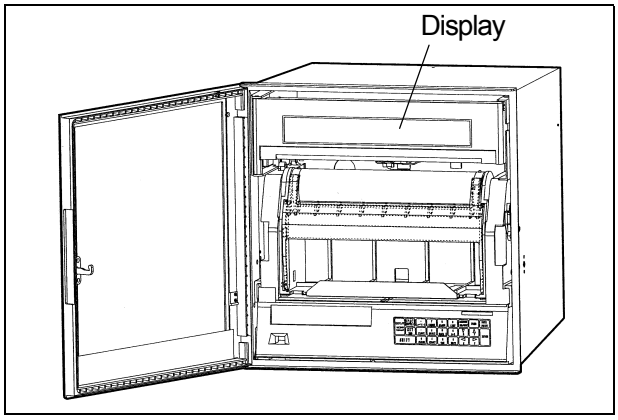
<table>
<tr><th></th><th>Display functions</th><th>Printing functions</th></tr>
<tr><td>Multi-point sequential display</td><td>・Measured values are displayed sequentially every channel.
・Chart speed and time are displayed.
・Six kinds of status are displayed.
・Alarm-on channel number are displayed.(Note)</td><td rowspan="3">・Trace printing all channels by dots
・Fixed time printing (time line, time, scale, engineering unit, tag)
・ Periodic data printing (Measured values are digitally printed at preset intervals)
・Digital data printing (Digital printing of measured values on demand)
・Alarm printing (Note)</td></tr>
<tr><td>Multi-point simultaneous display</td><td>・Simultaneous display of measured values in 6 channels or 12 channels (12-point selective display for 24 channels)
・Three kinds of status are displayed.
・Operation display screen selection.
・Measured values flicker if alarm is on.(Note)</td></tr>
<tr><td colspan="2">・Operation screens selectable</td></tr>
</table>

Note: Programming of alarms is necessary. Alarm output is only available by adding an option of [Alarm output].

DISPLAY SPECIFICATIONS

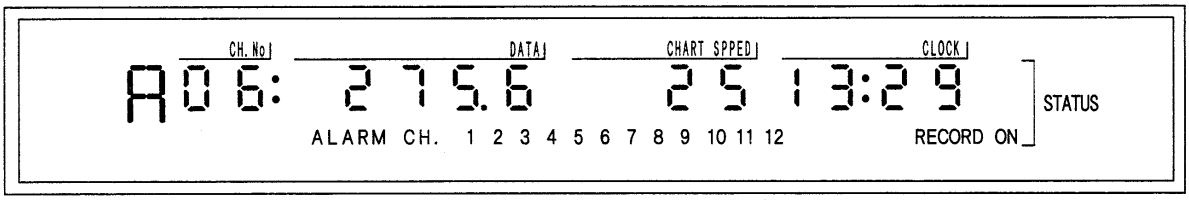
Two kinds of display system for the multi-point sequential display and multi-point simultaneous display are available. The display arrangement and displaying contents differ, but the operation is almost same.

The right figure shows the multi-point sequential display. In this instruction manual, the multi-point sequential display is mainly illustrated

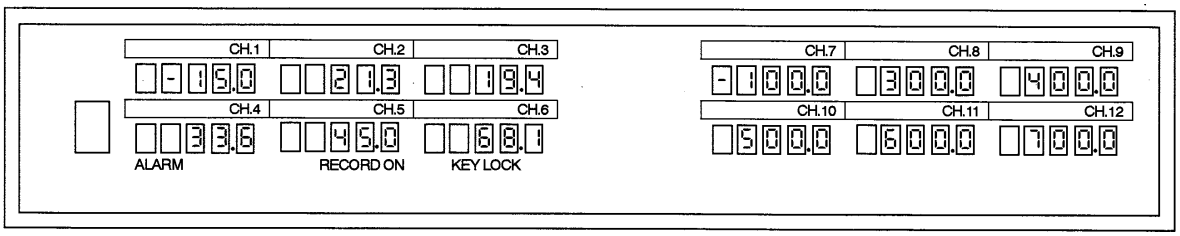


1. Display arrangement

1) Multi-point sequential display



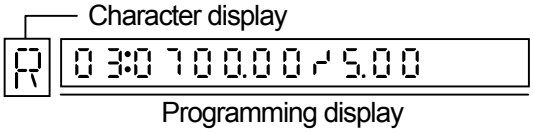
2) Multi-point simultaneous display……For 12-point input (6-point and 24-point inputs are also available.)



2. Programming Display

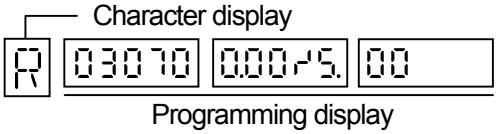
1) An example of programming display

・In case of multi-point sequential display



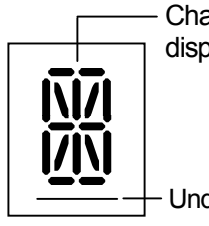
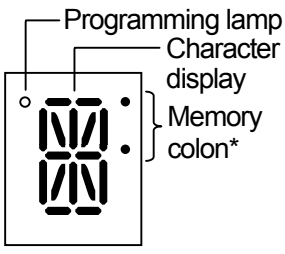
・In case of multi-point simultaneous display

The programming is executed on the lower left side of the display. No colon appears on the right of channel number.



2) Character display

Displaying methods during programming and storing to memory differ between two display systems.

Multi-point sequential display	Multi-point simultaneous display
 *Lights during programming and flickers during storing into memory.	 *Flickers during storing into memory.

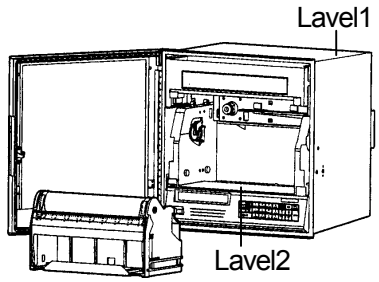
1. GENERAL

1.1 Model Check and Information

1. Model check

A label showing the model is stuck to the upper face of the case as well as the bottom face of the internal unit after drawing out the chart cassette.

MODEL	AH3720-N00	Model
No.	987B001	Serial No.



Reference Drawing out the chart cassette

See 5.1.

2. Information

1) Attached chart

Chart No. EH-01001 (0 to 100) will be delivered. Charts conforming to various scales are also available as shown below.

Scale	Chart No.	Scale*	Chart No.
0 to 50	ET-024	0 to 50°C	EH-05045
0 to 100	EH-01001	0 to 100°C	EH-05001
0 to 150	ET-018	0 to 150°C	EH-05044
0 to 200	EH-01013	0 to 200°C	EH-05043
0 to 300	EH-01004	0 to 300°C	EH-05041

*Each scale is linear. It is usable irrespective of the types of thermocouples and resistance thermometers.

2) Printing restrictions

1.None of digital printing is done at a faster chart speed than 251 (mm/h).

2.Trace printing is executed at fixed intervals. However, these executed intervals may be more or less longer if they overlap with digital printing.

3.Digital printing is executed by 1-pin dots and a character is composed of 7 lines. If power supply is turned off halfway, a complete character cannot be formed.

■Models

AH37[2][0]–[N][0][0]

Input signal
- [7] Fixed: Universal input (DC voltage, thermocouple, Resistance thermometer)

No. of input points (A,B,D: option)
- 6: 6-point 2: 12-point 4: 24-poin….Measuring interval is approx. 5 sec. per 6 points
- A: 6-point B: 12-point D: 24-point….Measuring interval is approx. 1 sec. per 6 points

Display specifications
- 0: Multi-point sequential display
- 5: Multi-point simultaneous display (Simultaneous display of 6, 12 points input, 12 points sequential display of 24 points input)

Communications interface (option)
- N: None A: RS-422A S: RS-485 R: RS-232C

Alarm output and remote contacts (option)
- 0: None
- 1: 6 MOS relay outputs + remote contacts
- 2: 6 mechanical relay 'c' contact outputs + remote contacts (*)
- 3: 12 MOS relay outputs + remote contacts
- 4: 12 mechanical relay 'c' contact outputs + remote contacts (*)
- 5: 24 MOS relay outputs + remote contacts
- 6: 24 mechanical relay 'c' contact outputs + remote contacts (*)
- A: 6 mechanical relay 'a' contact outputs + remote contacts
- B: 12 mechanical relay 'a' contact outputs + remote contacts
- D: 24 mechanical relay 'a' contact outputs + remote contacts
- *: Mechanical relay 'c' contact outputs do not conform to the international safety standards.

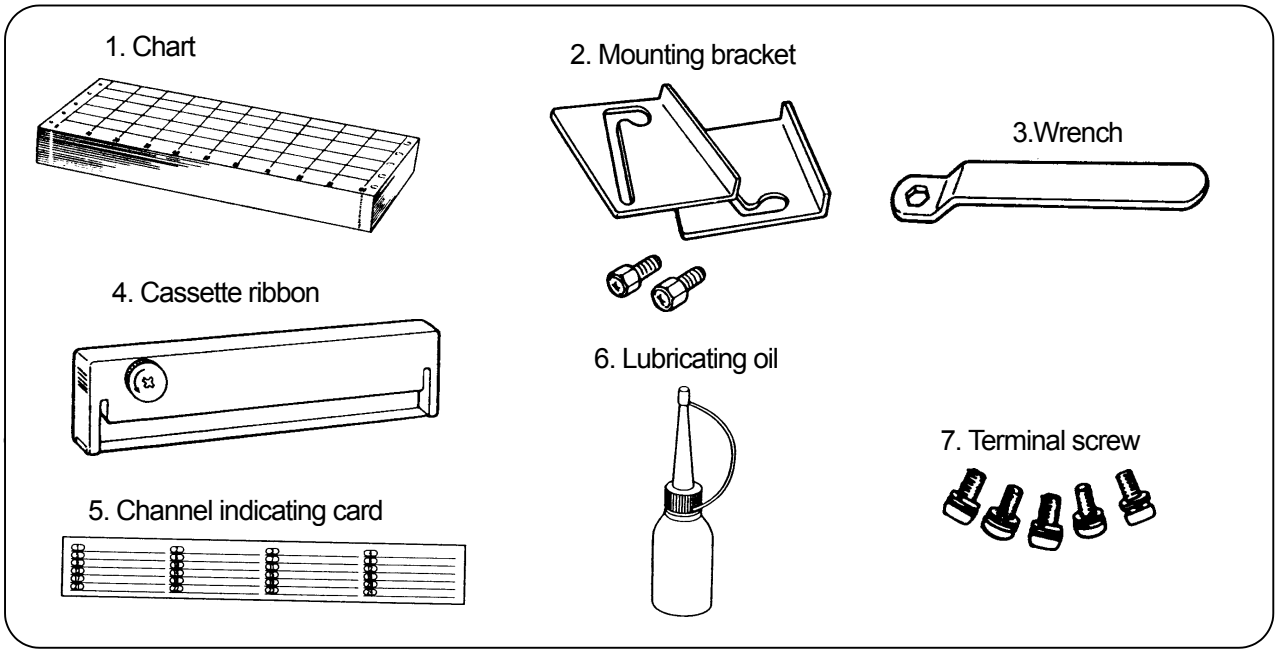
Others (option)
- 0: None 1: Printing format + high-speed trace printing

1.2 Attachments and Consumable Parts

1. Attachments check

The following attachments are contained. Check if these attachments are delivered normally.

Part names	Q'ty	Remarks
1. Chart	1 pad	Chart No. EH-01001
2. Mounting bracket	2 pcs.	Used for mounting the instrument to a panel. Hole profiles differ between right and left sides.
3. Wrench	1 Pc.	Fasten mounting screws
4. Cassette ribbon	1 Pc.	6-color ink ribbon for analog and digital printing
5. Channel indicating card	1 sheet	Inserted inside the door (For 6 points, 12 points, or 24 points)
6. Lubricating oil	1 bottle	For lubricating the main shaft of printer
7. Terminal screw	5 pcs.	M3.5 screws Auxiliary screws for input and alarm terminals
8. Instruction manual	1 pad	INE-271 (for instruments)
	(1 pad)	INE-272 (for communications interface) Attached to the instrument with communications interface.



2. Ordering of consumables

Chart and cassette ribbon are consumables. For ordering them, please specify them, referring to the following table.

Name	Article name and specifications for ordering	Handling unit
Chart	Chart No. (Example EH-01001)	1 case (containing 15 pads)
Cassette ribbon	6-color cassette ribbon (For AH: No. 84-0055)	1 piece

2. INSTALLATION

2.1 Mounting Place and External Dimensions

Mount the instrument at the following place so as not to affect the measuring accuracy and recording operation unfavorably.

1. Industrial environment

Select a place being separated from electric field and magnetic field generation sources and also free of mechanical vibrations and shocks.

- ·OVERVOLTAGE CATEGORY…… II
- ·POLLUTION DEGREE……2
- ·Altitude……Lower than 2000m
- ·Working place…….Indoors

2. Ambient temperature and humidity

Don't expose the instrument to the direct sunlight. Don't enclose the instrument to prevent a temperature rise.

- ·Mount the instrument at a stable place where the ambient temperature is about 23°C and the relative humidity is about 50% RH.
- ·Mount the instrument at a place free of being exposed to hot blast (higher than 70°C) for preventing its door from being deformed.
- ·Mount the instrument at a place being free of a heat source near its terminals for the purpose of reducing measuring errors.

3. Atmosphere

- ·Don't mount the instrument at an inflammable gas atmosphere for securing safety.
- ·Don't mount the instrument at any place where dust, smoke, vapor, and other substance exist.

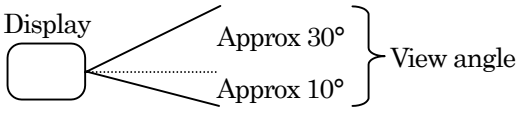
4. Mounting angle and display view angle (Multi-point simultaneous display)

1) Mounting angle

- ·Lateral tilting……0° to 10°
- ·Longitudinal tilting…...Forward tilting: 0 °
  Backward tilting : 0° to 30°

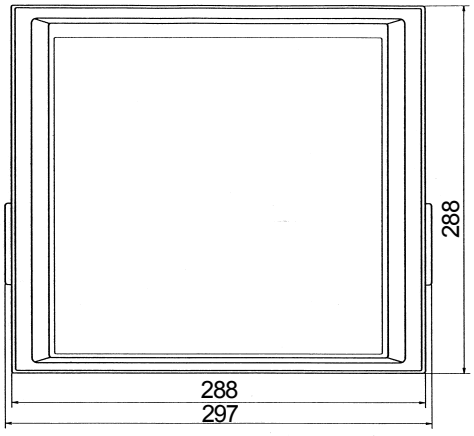
2) Display view angle

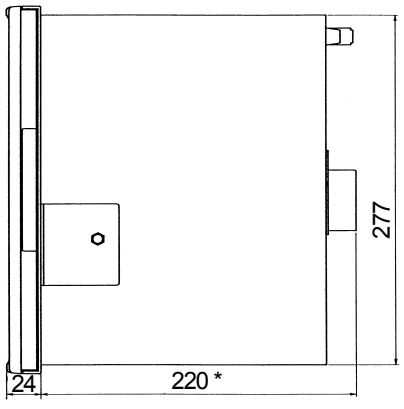
- ·View angle…….-10° to +30° based on horizontal



5. External dimensions

The following figure shows the external dimensions of the instrument together with its mounting brackets.





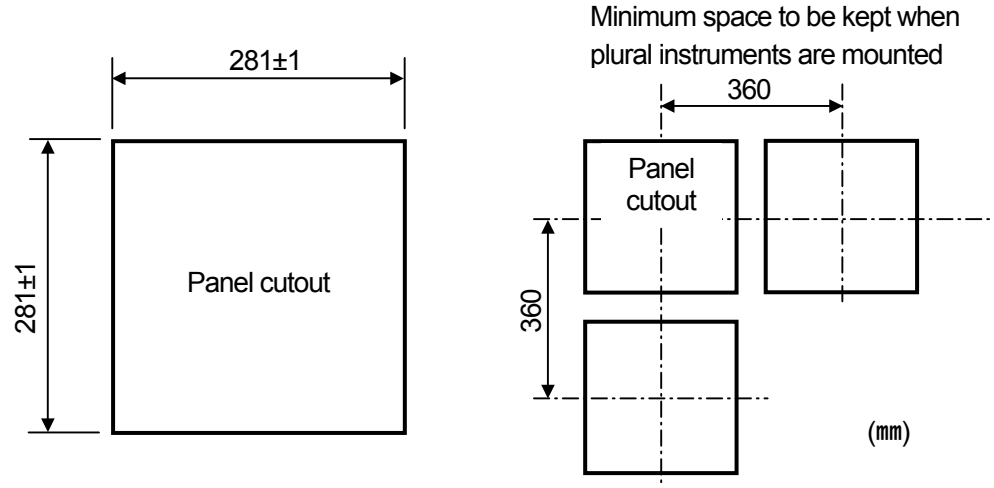
*When communications interface or alarm (Note) + remote contacts is added by 16 mm
(Note) Mechanical relay 'a' contact outputs + remote contacts is added by 11 mm furthermore.

2.2 Mounting Method to Panel ⚠

Warning Mount the instrument on a panel

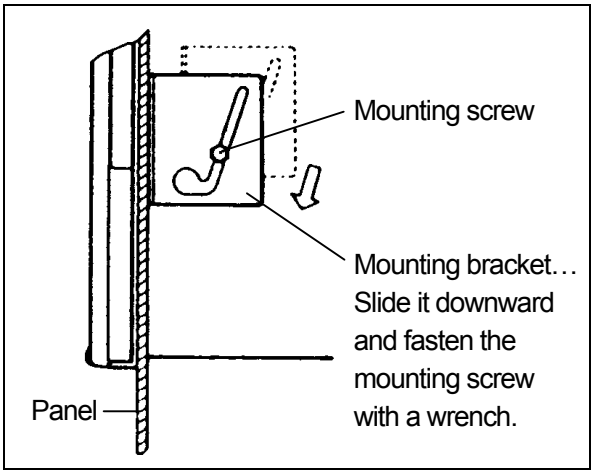
This instrument is designed to be mounted on a panel.
Use a panel made of a steel plate of 2 mm to 6 mm in thickness.

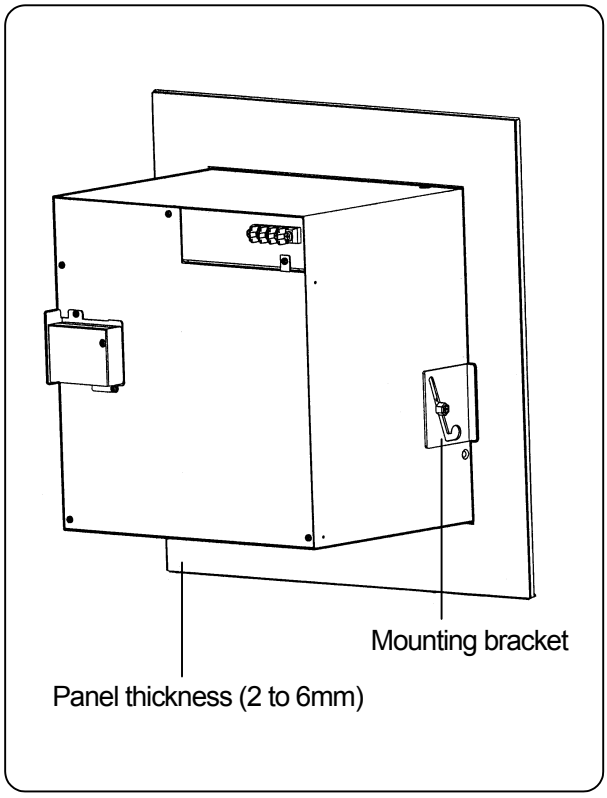
1. Panel cutout size



2. Mounting method

1) Insert the instrument into the panel cutout from the front of the panel.
2) Screw the mounting screws lightly into the mounting bracket screw holes on the right and left sides of the case.
3) After putting the mounting screw into a larger hole of the mounting bracket, slide the mounting bracket downward and attach it to the panel closely. Then, fasten the screw with the wrench (tightening torque 1.2 N.m).



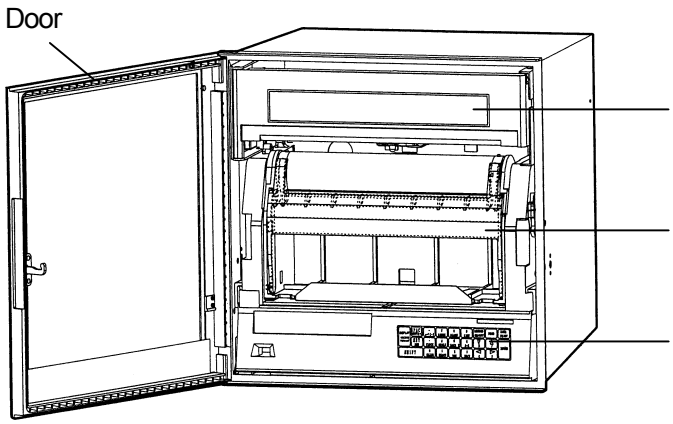


The above figure shows the mounting bracket on the right side as viewed toward the front.

3.NAMES OF COMPONENT PARTS

3.1 Front Panel ⚠

All operations of this instrument including the installation of ribbon cassette can be done from the front.



⚠ **Caution** How to handle the door

The front face of the door is made of glass. Don't give any shock to the glass face nor give any strong force to the frame for preventing an injury due to the breakage.

1) Display board

Two kinds of display board for the multi-point sequential display and multi-point simultaneous display are available. For installing the cassette ribbon, swing open the display board to the left. For details of the display board, refer to the next page.

2) Chart cassette

Load the chart to the chart cassette.

3) Keyboard

For operation and programming, press necessary keys.

- Operation keys

[DISPLAY RECORD FORMAT] Three operation screens are switched by pressing this key.

[RECORD ON/OFF] → [ENTRY] Turns printing ON or OFF.

[FEED] Feeds the chart at a speed of about 10(mm/sec) when this key is being pressed.

[DATA PRINT] → [ENTRY] Prints measured value digitally at the time when this key is pressed (on demand).

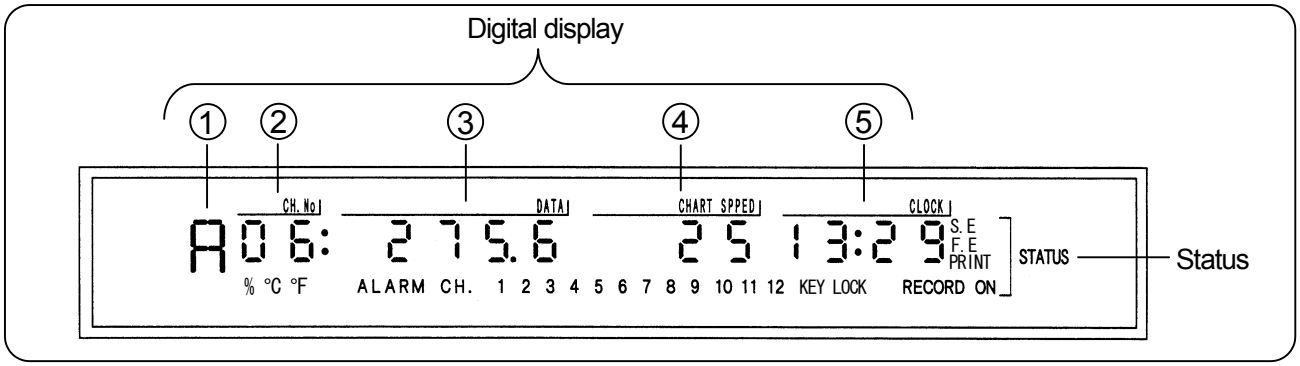
[SHIFT] + [9 LIST] → [ENTRY] Prints the programmed parameters as a list.

- Programming keys

Press various keys other than described above.

3.2 Display Board

1. Multi-point sequential display



1) Digital display

1. Operation screen A : Multi-point sequential display screen C : One-point continuous display screen 2. Channel Number (CH No.) Channel number of measured value (DATA)	3. Measured value (DATA) Measured value of channel number (CH.No.) 4. Chart speed (CHART SPEED) Displays the chart speed. 5. Time (CLOCK) Displays the current time (hour and minute).

3) Status

- PRINT(green)……..Flickers during digital printings.
- ALARM CH.(red)……Illuminates when alarm is ON.
- 1 2 3 …12 (green)…….Alarm-on channel numbers flicker in Channels 1 to 12. Alarm-on channel numbers in Channels 13 to 24 are not displayed, but they can be checked in par. 10.4.
- KEY LOCK (red)……..…...Illuminates during key lock status.
- RECORD ON (green)……..Illuminates when printing is ON.

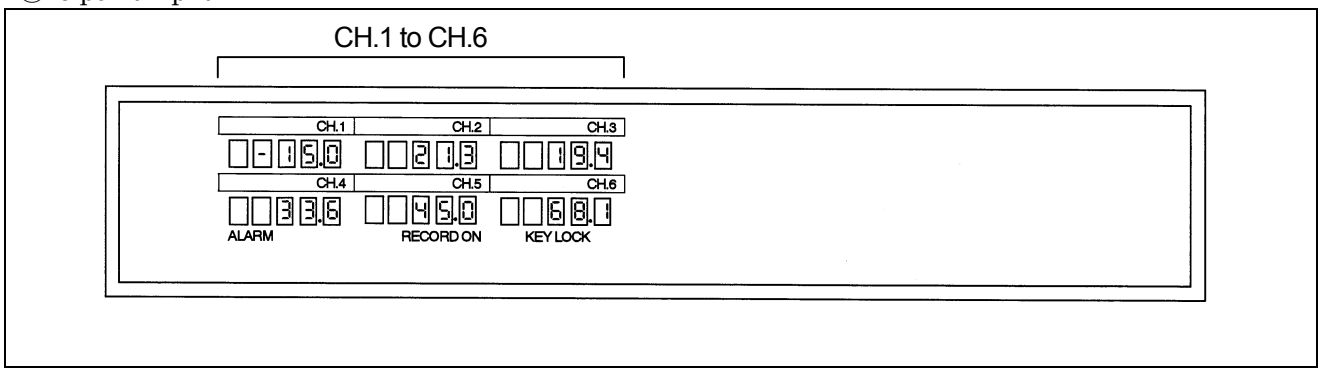
(References) % °C °F…… "Special characters" Special characters illuminates (green) in this screen during programming for engineering unit and tag.
S.E, F.E……"Programming error" Flickers (red) if programming is wrong.

2 Multi-point simultaneous display

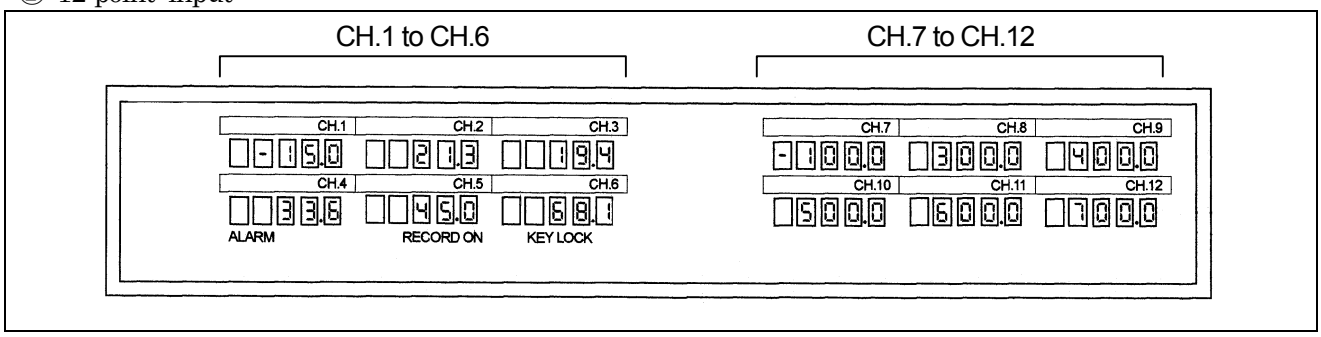
The arrangement and channel number display differ by the number of input points (6 points, 12 points or 24 points)

1) Arrangement

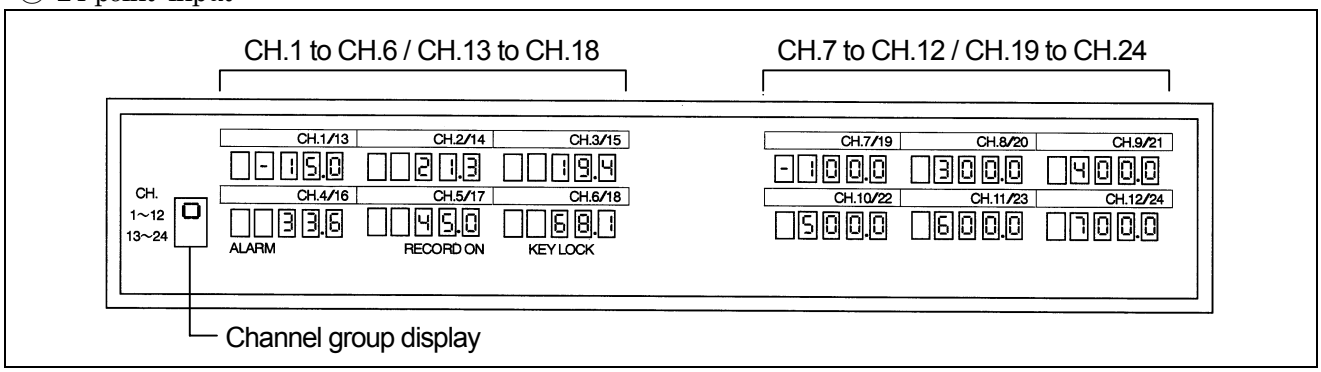
① 6-point input



② 12-point input



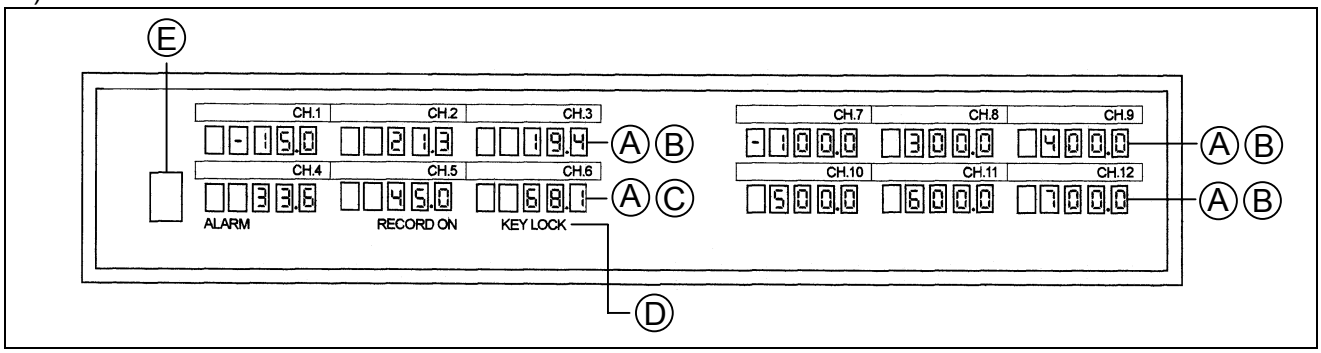
③ 24-point input



Reference Channel group switching

For the group switching method of Channels 1 to 12 and Channels 13 to 24, see par. 6.4.

2) Names



①Measured value display/time display, and others.

・Measured value display (A)

Measured value display is sorted into the right side or left side according to channel numbers.

Number of points	Left side	Right side
6 points	1 to 6 CH	
12 points	1 to 6 CH	7 to 12 CH.
24 points	1 to 6 CH	7 to 12 CH.
	13 to 18 CH	19 to 24 CH.

・Time display (C), others (B)

Display positions differ between 6-point input and 12-point/24-point inputs.

(B) displays the chart speed and alarm status (1: Alarm-on, 0: Alarm-reset).

For details, see par. 6.4.2.

②Status display (D)

・ALARM (red)……..…Illuminates when alarm is ON.

・RECORD ON (green)……...Illuminates when printing is ON.

・KEY LOCK (red)……...Illuminates during key lock status.

③Channel group display (E)

Measured values in Channels 1 to 12 or Channels 13 to 24 are displayed simultaneously and two groups of Channels 1 to 12 and Channels 13 to 24 are switched automatically or manually. The switching conditions are shown below.

Automatic group switching		Manual group switching	
(CH. 1 to 12)	(CH. 13 to 24)	(CH. 1 to 12)	(CH. 13 to 24)
1 to 12 13 to 24 Flickers	1 to 12 13 to 24 Flickers	1 to 12 13 to 24 Lights	1 to 12 13 to 24 Lights

Reference Operation screen selection

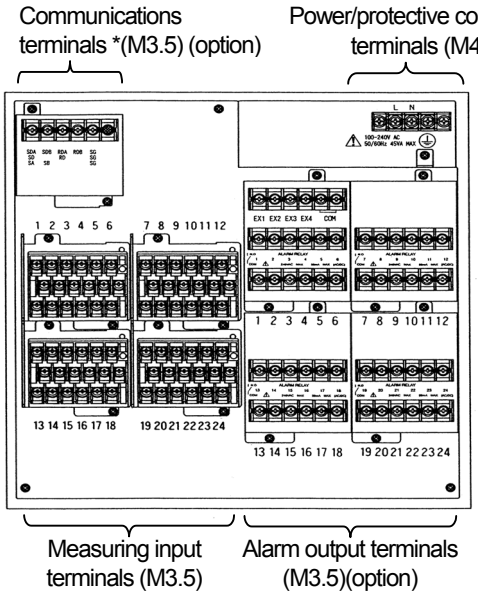
The screens of [measured value display] and [clock display, and others] are switched by pressing [Display] key. For the 24-point input, the screen is switched in the order of [display of measured values by automatic group switching] - [display of measured values by manual group switching] - [clock display, and others].

4. CONNECTIONS

4.1 Terminal Board Diagram ⚠

The terminal board shown in the following figure is for the instrument with options (alarm output + remote contacts and communications interface) are mounted.

(Caution)
Alarm output terminals illustrated are MOS relay output and mechanical relay 'a' contact outputs. Mechanical relay 'c' contact outputs (The international safety standards do not conform) differ the terminal configuration.



⚠ **Warning** Alert symbol marks (⚠) and places

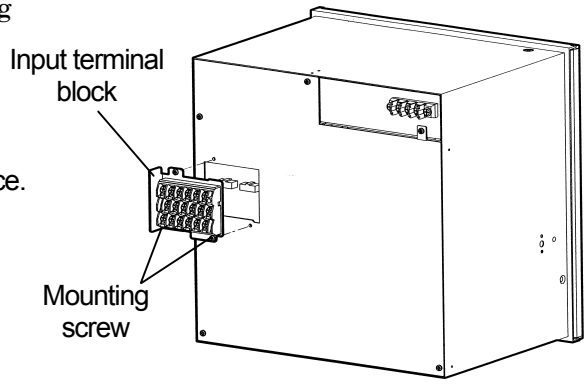
The alert symbol mark (⚠) is mounted at a place where one may receive an electric shock if one should touch. (See the following table) Read paragraphs describing the connections of individual terminals.

Name of terminals	Power terminals	Measuring input terminals	Alarm output terminals
Mounting place of label	Lower left of power terminals	Upper left of terminal cover	Upper left of terminal cover

Reference Input terminal block and alarm terminal block are removable

The input terminal block and alarm terminal block* are removable for easy connections.
*The terminals for the remote contacts are included.

1) Each terminal block can be removed by removing two mounting screws.
2) Each terminal block is connected to the instrument by a connector.



⚠ **Caution** Turn off the power supply in advance.

For mounting or dismounting the terminal block, turn off the external power switch for the purpose of preventing the electric circuits from being damaged.

Remarks Replacement of terminal block

If the input terminal block is replaced with a new one, the calibration of thermocouple inputs becomes incorrect.

4.2 Cautions on Connections ⚠

Observe the following cautions during connections for securing safety and reliability.

1. Feed source power supply

Use a single-phase power supply having a stable voltage without any waveform distortion for the purpose of preventing wrong operations.

⚠ Warning Addition of a switch and an over current protective device

Add a switch and an overcurrent protective device (3A) to the feed source power supply for preventing an electric shock accident during connection work. This instrument is not provided with any replaceable overcurrent protective device.

⚠ Warning Turn off the feed source power supply before starting connections

Turn off the feed source power supply in advance without fail for preventing an electric shock accident when the power supply and input/output terminals are connected.

2. Separate input/output connections from a strong power circuit

Don't place the input/output cables to be close to or in parallel with any strong power circuits including power line. Separate them more than 50 cm from strong power circuits when they are placed to be close to or in parallel with strong power circuits.

3. Separate the thermocouple input terminals from a heat source

For thermocouple inputs, separate the input terminals from a heat source (a heating body) for a purpose of reducing a reference junction compensation error. Don't expose the input terminals to the radiation of direct sunlight, etc.

4. Separate all connection cables from noise sources

Separate all connection cables to the instrument from a noise source as far as possible, otherwise an unexpected trouble may occur. Take a remedial measure if the cables cannot be separated from a noise source due to unavoidable circumstances.

Major noise sources	Remedial measures
Electromagnetic switch, power line having waveform distortion, inverter, thyristor regulator	Insert noise filters between power terminals and input/output terminals. A CR filter is often used.

5.Use crimp style terminals

1) Mount crimp style terminals as connection cables' termination for preventing the looseness or disconnection of terminals and a short-circuit failure between terminals.
2) For crimp style terminals, use an insulation sleeve for preventing an electric shock accident.

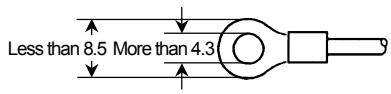
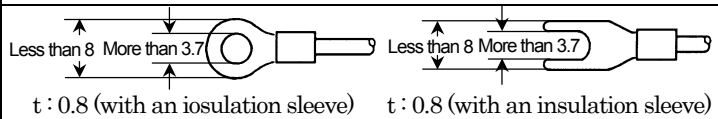
6. Unused terminals

Don't use any unused terminals for relaying, otherwise electric circuits may be damaged.

⚠ Warning Treat connected cables properly

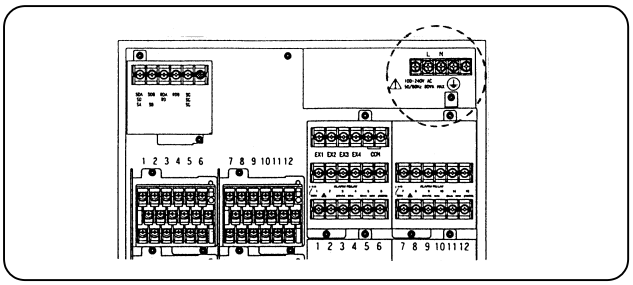
Treat connected cables securely so as not to allow them to be hooked by a person or a substance, otherwise the connections may be disconnected or cut to cause an electric shock accident or other accidents.

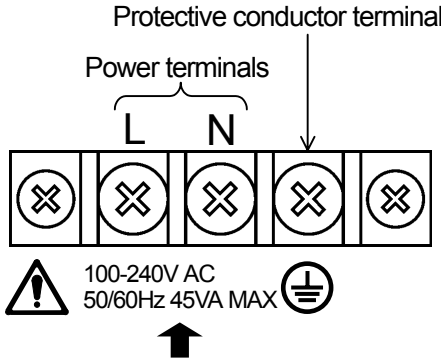
Reference Kinds of terminals and terminarion

Terminal name	Screw diameter	Tightening torque	Termination (unit: mm)
Power and protective conductor terminals	M4	1.2 N.m	 t : 0.8 (with an insulation sleeve)
Terminals other than described above	M3.5	0.8 N.m	 t : 0.8 (with an iosulation sleeve) Use O-chip (left side) t : 0.8 (with an insulation sleeve)

4.3 Power and Protective Conductor Terminals ⚠

1. Power terminals and protective conductor terminal





⚠ **Warning** Turn off the feed source power supply

Turn off the feed source power supply without fail before connecting the power terminals and protective conductor terminal for the purpose of preventing an electric shock accident.

Remarks L.N indication of power terminals

This indication conforms to the CSA standard, Canada. The live side of the single-phase AC power supply is indicated as L, and the neutral side is indicated as N. Observe the L.N connections for obtaining satisfactory performance.

2. Connection of power terminals

For the connections to power terminals, use a 600V vinyl insulated cable (IEC 227-3 Note), with the crimp style terminals and an insulation sleeve.

Note: Use the cords approved by the following standards.

1) IEC 227-3 or 2) ANSI/UL817

3) CSA C22.2 No.21/No.49

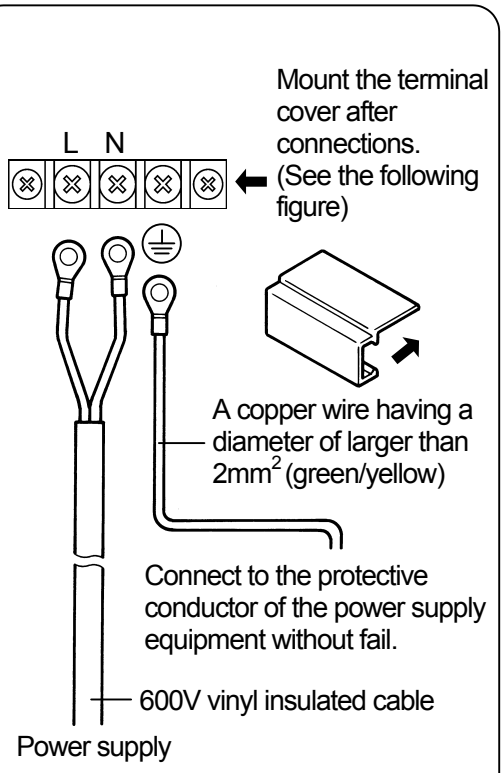
⚠ **Caution** Be careful with the power voltage and noises.

The power voltage of this instrument is indicated beside the power terminals. Don't apply any voltage other than indicated, otherwise a trouble occurs or malfunction results. If noises are mixed into the power supply, take a remedial measure, such as the addition of a noise cut transformer, etc.

3. Connection of protective conductor terminal

Connect this terminal to the protective conductor of the power supply equipment without fail. For this connection, use a cable with a crimp style terminal and an insulation sleeve.

Grounding wire : A copper wire having a wire diameter of larger than 2mm^2



⚠ **Warning** ⚠ mark at power terminals

A voltage of 100 to 240V AC is applied to the power terminals after connections. Mount the power terminal cover without fail after connections for the purpose of preventing an electric shock accident.

4.4 Measuring Input Terminals ⚠

1. Measuring input terminals

Turn off the feed power source for preventing an electric shock accident.

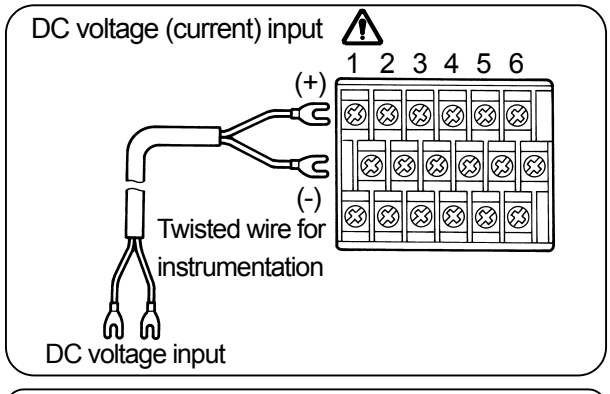
1) Measuring input terminals are provided at the lower part of the terminal board.
2) For the connections to input terminals, use cables with crimp style terminals and an insulation sleeve.

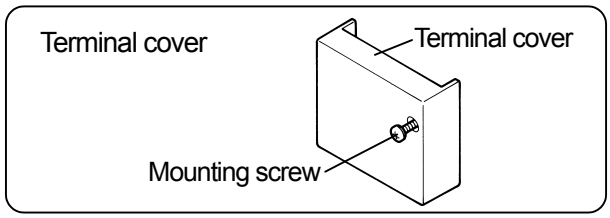
⚠ **Caution** Allowable input voltage

Input type	Allowable input voltage
Voltage Thermocouple input	± 10VDC (Range of less than ±2V) ± 60VDC (Range of more than ±5V)
Resistance thermometer input	±6VDC

2. Connections of DC voltage (current) input

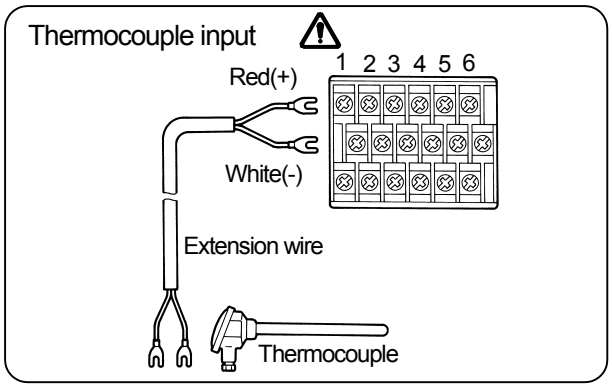
Use a twisted cable for instrumentation as the input cable for the purpose of suppressing noises. For current inputs, mount shunt resistors (par. 15.2) to the channels to be measured before connections.





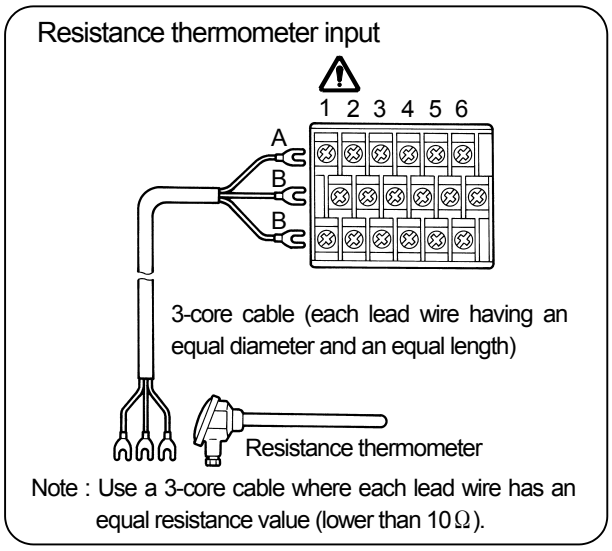
3. Connections of thermocouple inputs

Use a thermocouple wire (or extension wire) to the input terminals of this instrument without fail. If a copper wire is used halfway, a noticeable measuring error occurs. Don't use a pair of thermocouple wires in parallel with other instruments (controller, etc.) otherwise a trouble may occur.



4. Connections of resistance thermometer inputs

For the input wire, use a 3-core cable where each lead wire has an equal resistance value. Don't use one resistance thermometer in parallel with other instruments (controller, etc.).



⚠ **Warning** (⚠) mark of measuring input terminals

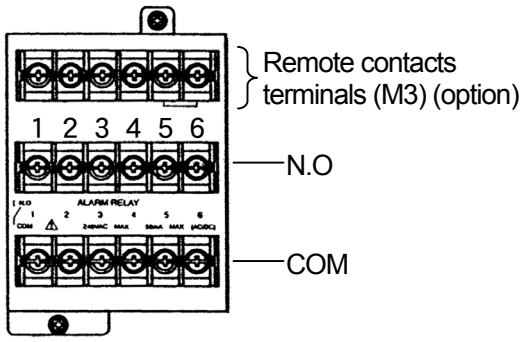
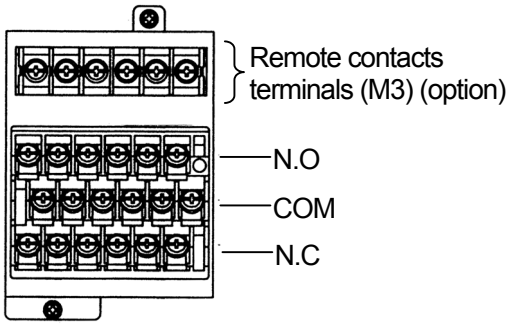
A high voltage may be applied to the measuring input terminals due to common mode noises. The allowable noise value is lower than 30VAC or lower than 60VDC. Make sure that the noises are lower than the allowable values. Mount the terminal cover after connections for the purpose of preventing an electric shock accident and protecting the input wires. In case of thermocouple inputs, an error of the reference junction compensation can be reduced by the terminal cover.

4.5 Alarm Output Terminals ⚠

The following connections apply to the instrument with an alarm output function (option) only. There are three kinds of alarm outputs available: (1) MOS relay, (2) mechanical relay 'c' contact and (3) mechanical relay 'a' contact output, which are shipped by the designated outputs. The mechanical relay 'c' contact output does not conform to the international safety standards.

1. Alarm output terminals

The terminal arrangement depends upon the type of alarm output.

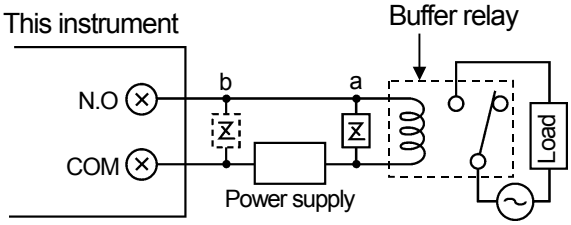
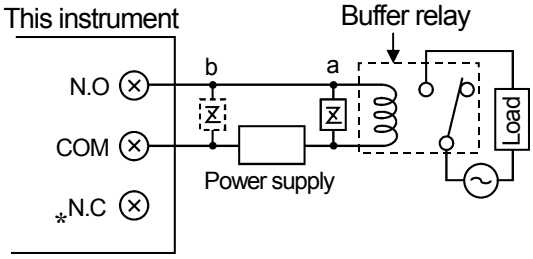
MOS relay and mechanical relay 'a' contact outputs	Mechanical relay 'c' contact output*
	* The international safety standards do not conform. 

2. Connections

Turn off the feed power source and buffer relay power supply before starting connections for the purpose of preventing an electric shock accident.

(1) Connect cables to the load via a buffer relay.

(2) Mount a crimp style terminal with an insulation sleeve to the alarm output terminals before connections.

Example of MOS relay and mechanical relay 'a' contact outputs	Example of mechanical relay 'c' contact outputs
 ⧖ : Contact protective element (It is recommended to mount this element on the 'a' side)	 ⧖ : Contact protective element (It is recommended to mount this element on the 'a' side) * N.O terminal ----- Close relay contact when alarm is on. N.C terminal ----- Open relay contact when alarm is on.

⚠ **Warning** ⚠ mark of alarm output terminals

Connect a load of less than specified (See Remarks 1 and 2) to the alarm output terminals. A buffer relay power supply is applied to the alarm output terminals after connections and an electric shock accident occurs if you should touch these terminals. Mount a terminal cover without fail after connections.

⚠ **Caution** Take a safety measure

An alarm output of this instrument may become defective due to wrong operation, failures, abnormal inputs, or other troubles. Take a safety measure against an output failure before use as occasion demands.

3. Cautions on connections

Be careful with the following remarks and references on connections.

Remarks 1 Contact rating of MOS relay output

Maximum voltage----240V (AC, DC)
Maximum current----50mA (AC, DC) *
*Irrespective of load types

Remarks 2 Contact rating of mechanical relay output*

Power supply	Resistive load	Inductive load
100V AC	0.5A	0.2A
240V AC	0.2A	0.1A
100V DC	0.3A	0.1A

*'a' contact and 'c' contact common

Remarks 3 Mounting of contact protective element Z

・Mount a contact protective element conforming to the buffer relay.
MOS relay is broken, if a signal exceeding the contact rating is applied even if momentarily.
・Mounting of the element on the coil side of the buffer relay ('a' in the left figure) is effective for preventing a wrong operation due to a light load.

Reference 1 Selection of buffer relay

1) Coil rating-------Less than the contact rating of output terminals
2) Contact rating--More than twice the load current

A coil surge absorption element built-in type relay is recommendable. Mount a buffer relay of an additional stage if a buffer relay satisfying the load rating is not available.

Reference 2 Selection of contact protective element

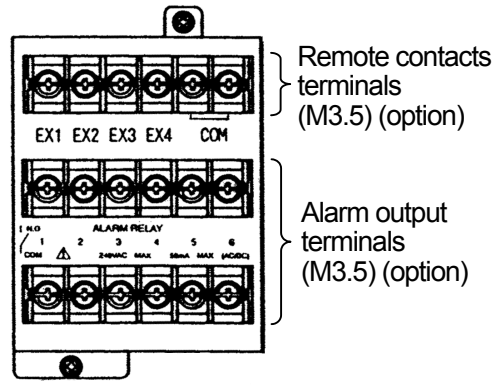
Mount a contact protective element if a surge absorption element built-in buffer relay is not available.
This element is generally composed of C (capacitor) and R (resistor).

<Reference values of C and R>
C: 0.0lμV (Rating about 1kV)
R: 100 to 150Ω (Rating about 1W)

4.6. Remote Contact Terminals ⚠

The following connections apply to the instrument having the remote contacts function (option) only. For the remote contacts, refer to par. 13.

1. Remote contacts terminals



2. Connections

Turn off the source power supply before starting connections for preventing an electric shock accident.

1) Apply a no-voltage contact signal to remote contacts terminals.
2) Connect a crimp style terminal having an insulation sleeve to the remote contacts terminals.

⚠ **Warning** No-voltage contact

For the contact to be connected to the remote contacts terminals, use a switch or relay driven at lower than 30VAC or lower than 60VDC or a manual contact for a very small load.

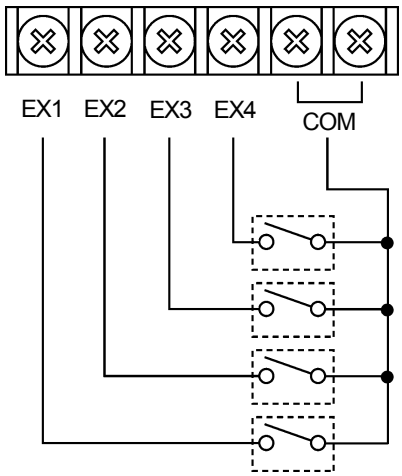
Terminal functions

Terminal names	Functions
EX1 and EX2	1) Printing ON/OFF 2) Selection of 3 chart speeds
EX3	Digital data printing
EX4	List printing

EX3 and EX4 require a short-circuit of longer than 1 second without any chattering.

When printing is turned off, RECORD ON/OFF and FEED keys become ineffective.

Connection example



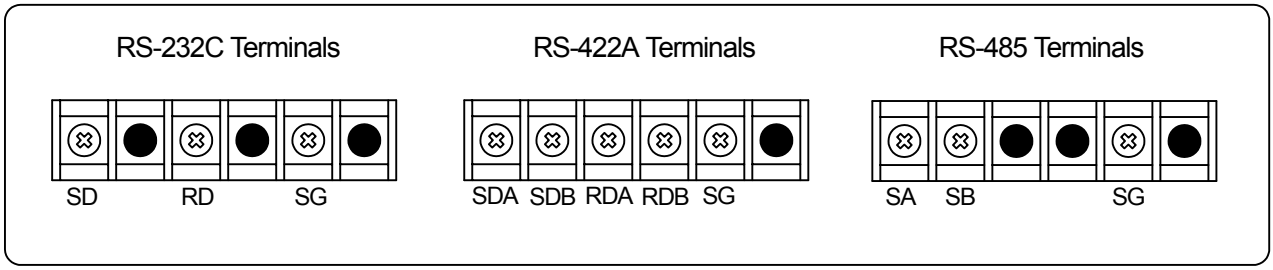
Remarks Remote contacts terminal characteristic

Voltage when the contact is open : Approx. 5V
Current when the contact is shorted : Approx. 2mA

4.7. Communications terminals ⚠

These terminals are for the communications interface (option). For details of the connection, refer to the instruction manual for the "Communications Interfaces" provided separately.

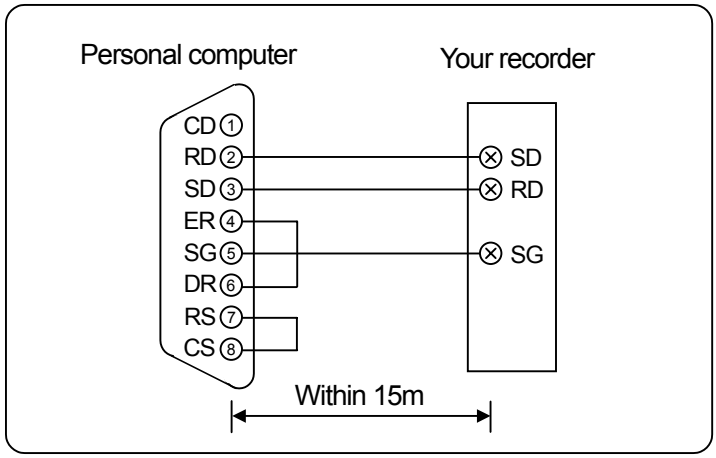
1. Communications terminals



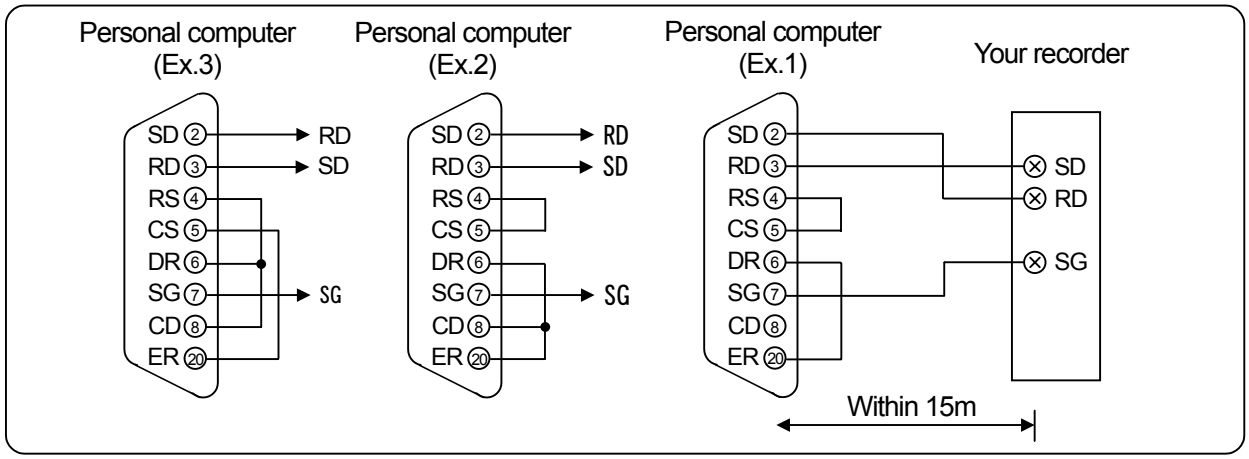
2. RS-232C Connections

When your recorder is with the communications interface of RS-232C, three terminals of SD, RD and SG are used but any control signal is not used. General personal computers are controlled by control signal. Wiring processing for control signal in a connector depends upon how the control signal is used in a personal computer. For details, refer to the instruction manual for your personal computer.

1) 9-pin connector



2) 25-pin connector



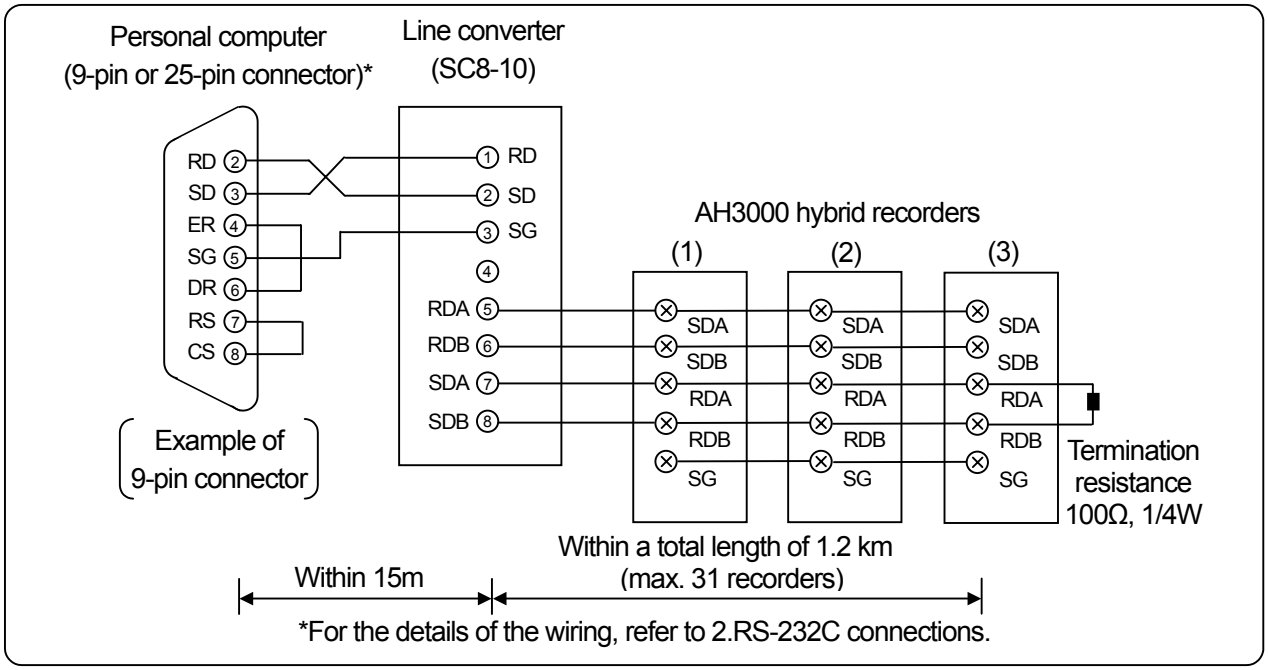
3. RS-422A, RS-485 Connections

RS-422/485 communications interface is connected to a personal computer via a line converter (our Model SC8-10: sold separately). Three signals of SD, RD and SG are used between the line converter and the personal computer but any control signal is not used. Wiring processing for control signal in a connector is necessary in the same as 2.RS-232C connections.

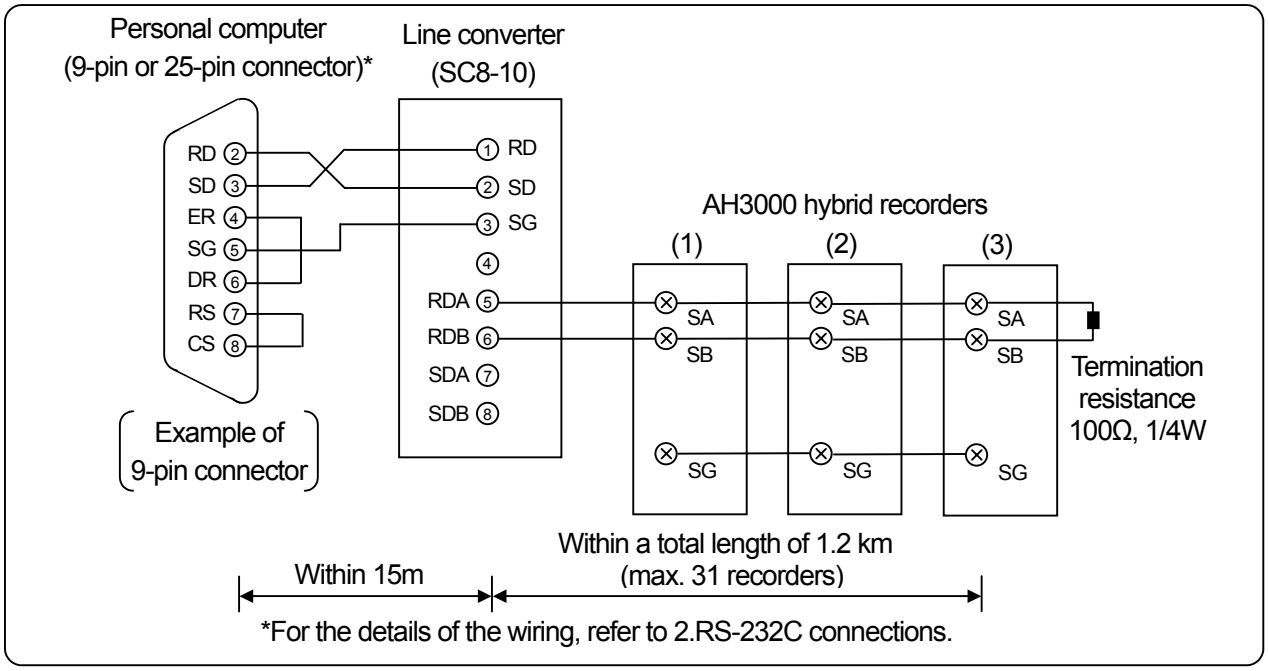
Caution Termination resistance

To ensure the transmission of data by RS-422A or RS-485, a termination resistance is required at both sides of transmission line. When the line converter (SC-8) is placed between a personal computer and this unit, short the terminal ④ and ⑤ of the line converter. By short-circuiting, a termination resistance is automatically inserted.

1. RS-422A



2. RS-485

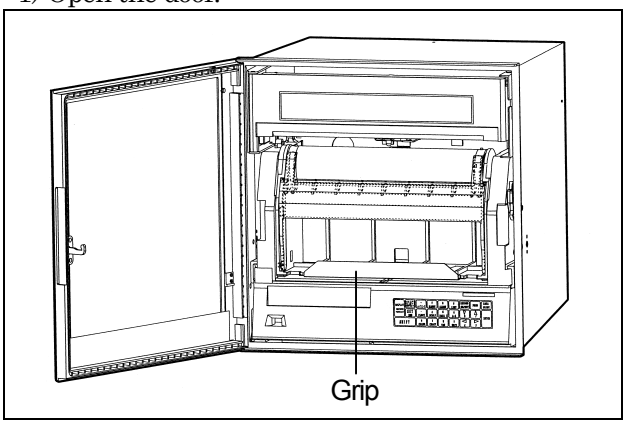


5. INSTALLATION

5.1. Chart Loading ⚠

1. Chart cassette removal

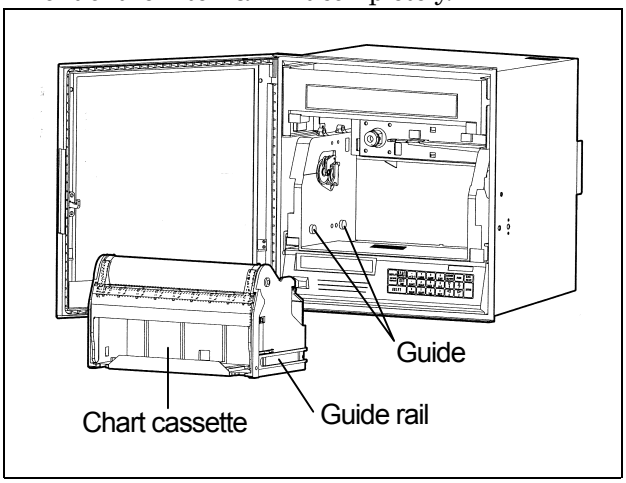
1) Open the door.



3) Remove the chart cassette.

①Pull the grip of chart cassette and take the chart cassette out of the instrument slightly.

②Pull the grip slowly to take the chart cassette out of the internal unit completely.

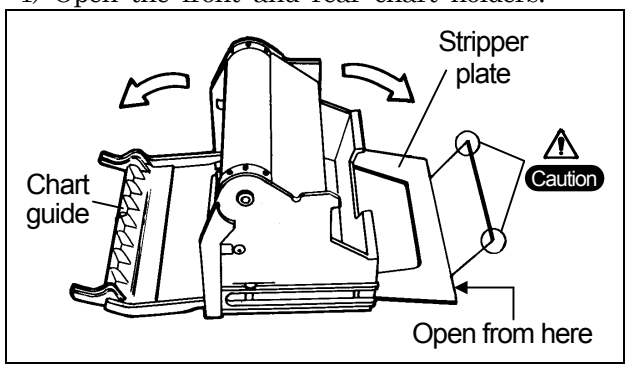


⚠ Caution Be careful with the corners of rear stripper plate.

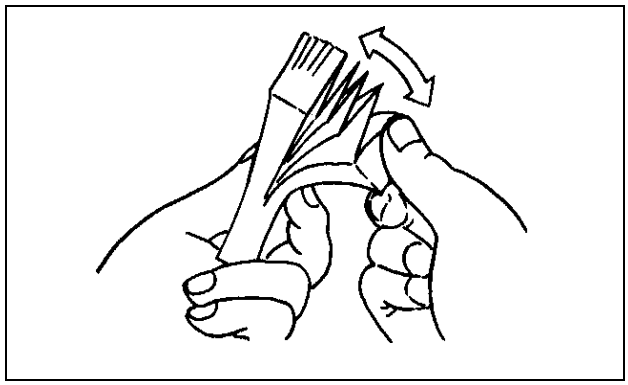
The corners of the rear stripper plate are acute for smoothing the chart feed.
Be careful not to cut your fingers when loading or replacing the chart.

2. Chart loading

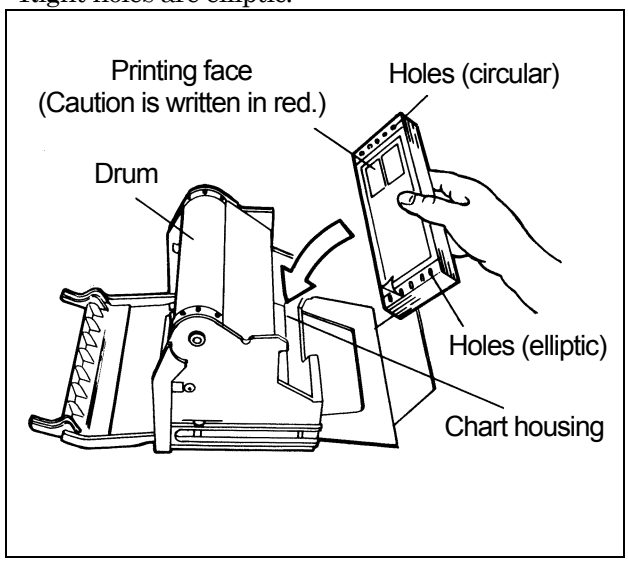
1) Open the front and rear chart holders.



2) Prepare a chart.
Shuffle both ends of the chart for preventing double feed.

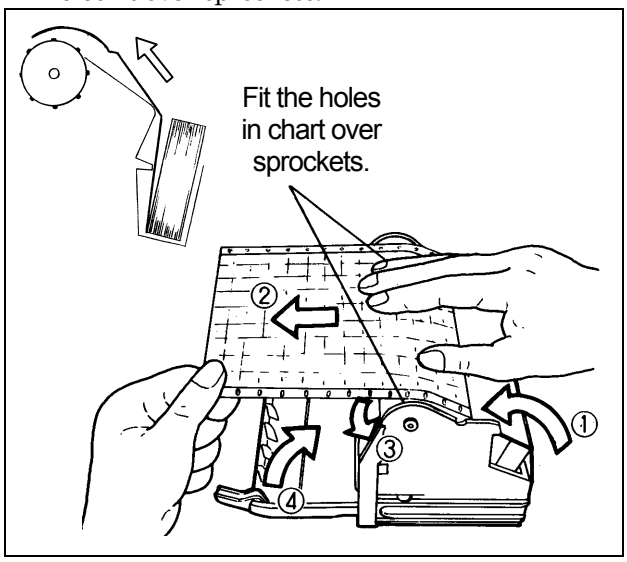


3) Put it into the chart housing.
Holes are different on the right and left sides.
Right holes are elliptic.



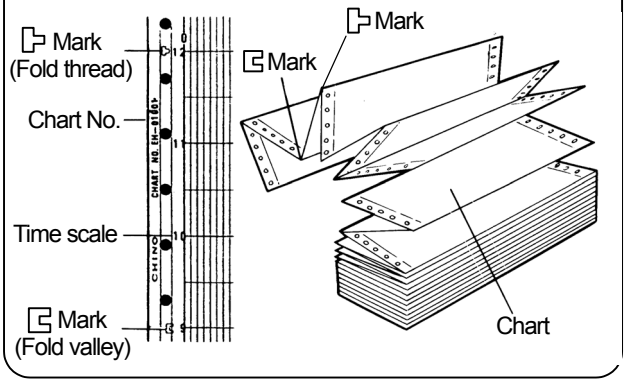
3. Sprocket

①Draw out the chart about 50cm and close the rear stripper plate.
②Fit the holes in chart over sprockets at both ends of the drum.
③Use thumb wheel to advance chart 2 to 3 folds into chart tray.
④Close the front chart guide. Make sure that the holes fit over sprockets.



Remarks Chart folds

mark for fold thread parts and mark for fold valley parts are printed on both ends of the chart.
Don't insert the chart folds reversely when inserting the chart into the chart tray, otherwise a folding failure results.



Reference Chart end mark

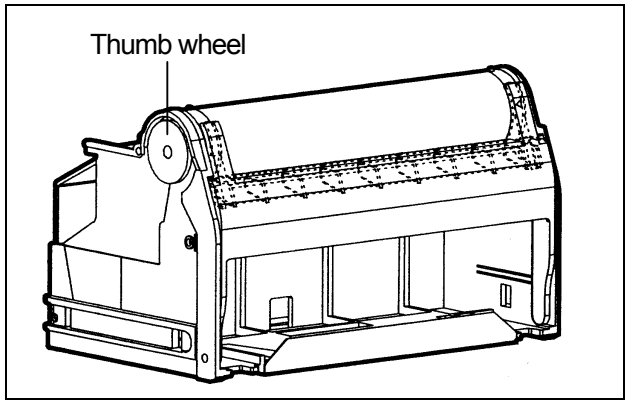
When the chart comes to an end, a red message "Prepare the new chart" appears on the right side.

4. Check

1) Manual check
Turn the thumb wheel by hand to make sure that the chart is feeding properly.

Remarks Turning direction of thumb wheel

Don't turn the thumb wheel inward, otherwise the chart cannot return and it causes a chart feed failure.



2) Chart cassette installation
Push the chart cassette loading the chart into the instrument.
・Chart cassette guides are mounted on the right and left sides of the internal unit. Push the chart cassette until a click is heard.

3) Chart feeding check
①Turn on the power supply.
②Press RECORD ON/OFF → ENTRY keys if RECORD ON is not illuminated.
③Press FEED key slightly and make sure that the chart feeds smoothly.
④Repeat the above procedure, if the chart does not feed smoothly.

5.2. Cassette Ribbon Installation

1. Preparation

1) Move the printer to the center.

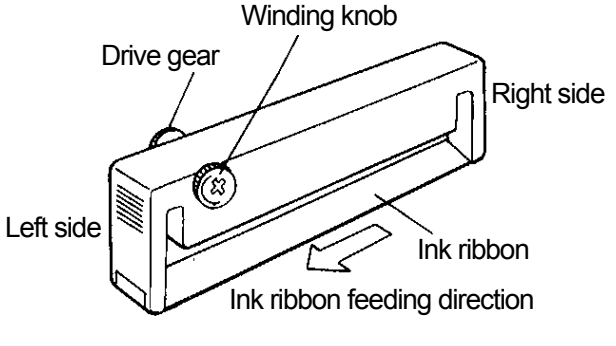
①Turn on the power supply.

②After initial operation, measured values are displayed.

③When the RECORD ON does not illuminate, it shows that the printer stops at about the center.

④If the RECORD ON illuminates, press RECORD ON/OFF → ENTRY keys not to illuminate. The printer stops at about the center.

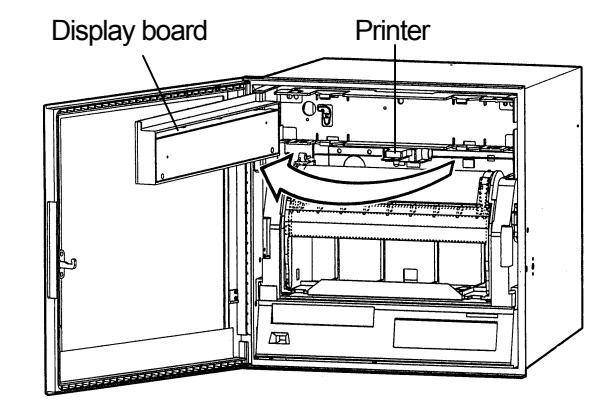
2) Cassette ribbon



2. Mounting

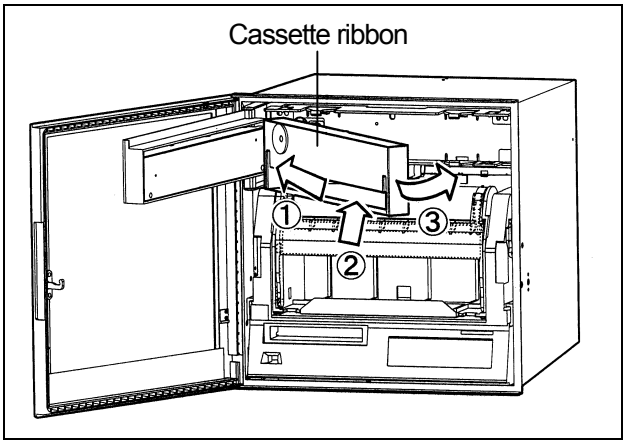
1) Open the display board

After opening the door, open the display board to the left.



The above figure shows without cassette ribbon loaded for the first installation.

2) Insertion of cassette ribbon



①Insert the cassette ribbon into the left holder.

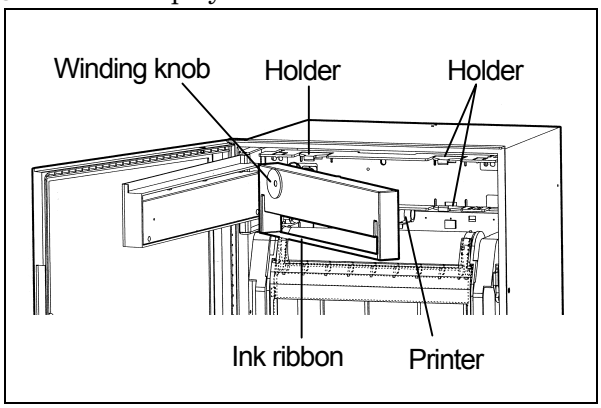
②Push the right side of the cassette ribbon so that the ink ribbon is inserted to the lower side of the printer.

③Insert the right side of cassette ribbon into the right holder.

④Make sure that the cassette ribbon is securely inserted into the claws of the right and left holders.

⑤ Turn the ribbon winding knob lightly counterclockwise.

⑥Reset the display board as before.



3) Ink ribbon feeding check

①By pressing RECORD ON/OFF → ENTRY keys, the RECORD ON illuminates and the ink ribbon feeds several centimeters.

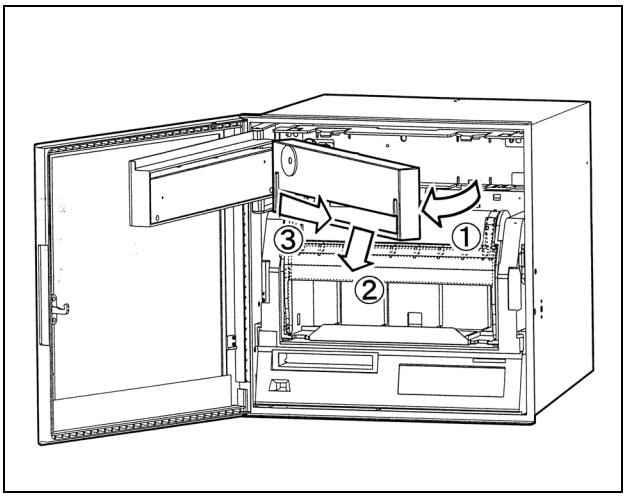
②Press RECORD ON/OFF → ENTRY keys several times. The ink ribbon feeds several centimeters when the RECORD ON illuminates.

3. Replacement

1) Preparation
①Move the printer to the center referring to 1.-1) on the last page.
②Prepare a new cassette ribbon.

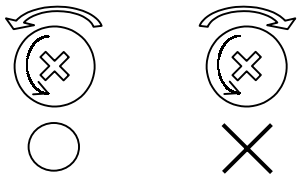
2) Open the display board.
After opening the door, open the display board to the left. For the figure, refer to 2.-1) on the last page.

3) Removal of old cassette ribbon
①Remove the old cassette ribbon from the right holder by pulling its right side.
②Pull the old cassette ribbon so that the ink ribbon is pulled out from the printer.
③Pull the cassette ribbon to remove it from the left holder.



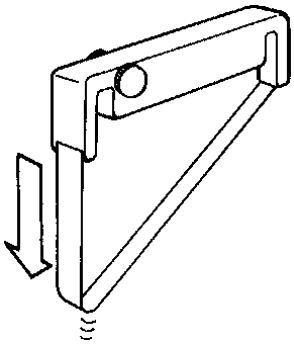
Remarks Winding knob direction

Don't turn this knob clockwise, otherwise a ink ribbon winding failure occurs.



Reference 1 If a winding failure occurred

After pulling out the left side of ink ribbon once, take up it by turning the winding knob.



Reference 2 Cassette ribbon replacement time

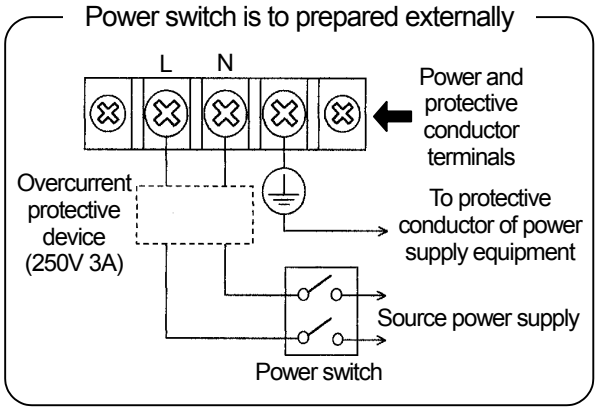
Cassette ribbon can be used for about 3 months under the standard conditions.
(Temperature: 23 ± 2°C, Humidity: 55 ± 10% RH)
The replacement time may become shorter depending upon the temperature, humidity, and operation methods (chart speed, periodic data printing interval time, etc.).

6. BASIC OPERATION

6.1. Turning On and Off the Power Supply and Operation

1. Turning on and off the power supply

This instrument is not provided with any power switch. Turn on and off by an external power switch for this instrument.



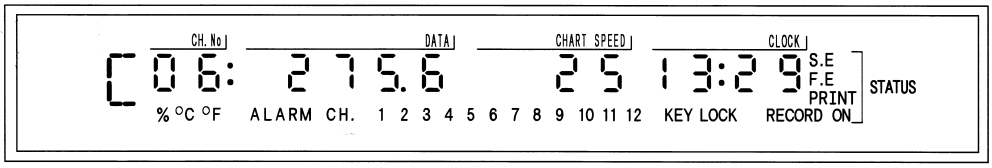
2. Initial operation

By turning on the power supply, the date (year/ month. day) is displayed, and year / month. day / time is printed at the end of initialization.

3. Operation

1) Display……In case of multi-point sequential display
Channel number, measured value (Note), chart speed, and time are displayed.
The default status is RECORD ON

(Note) The left end character ⊓ shows the multi-point sequential display (Proceeds to the next channel in about 5 seconds), while ⊔ shows the one-point continuous display.



[In case of multi-point simultaneous display]
The display configuration differs between 6 points, 12 points, or 24 points. See par. 3.2.3 (on page 3-3).

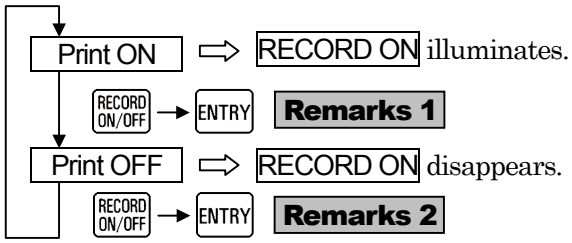
2) Chart feed
The chart is fed at the programmed chart speed. (The default speed is 25mm/h.)

3) Printing
①Trace printing
Measuring values are printed by dots at about 5-second intervals in the order of channels (by color).
②Fixed-time printing
The following data are printed at preset time intervals.
a. Time line b. Time c. Chart speed d. Channel, scale, and engineering unit
e. Year/month, day
③Other printings
The following printings are executed by programming and operation.
a. Periodic data printing b. Digital data printing c. Alarm-on and reset
d. List e. Programming change mark

6.2. Turning On and Off the Printing Operation

1. Turning on and off the printing

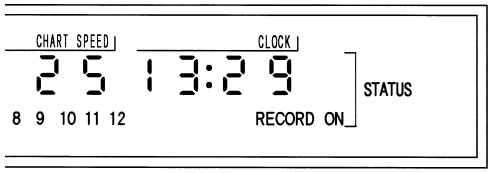
Printing is turned on and off selectively each time. [RECORD ON/OFF] → [ENTRY] keys are pressed.



The default status is RECORD ON .
When turning on the power supply, the instrument becomes the printing condition (printing on or off) just before turning off the power supply.

Status display when printing is turned on

RECORD ON illuminates.
In case of the multi-point sequential display, see page 3-3.



2. Printing operation

The right table shows the printing condition.

Operation	Print ON	Print OFF
Chart feed	Execute	Stop
Printing	Execute	Printer stops at about the center

Remarks 1 When [RECORD ON/OFF] → [ENTRY] key operation is not acceptable;

①The above key operation is not acceptable if KEY LOCK illuminates on the status display. For making the key lock ineffective (for resetting the key lock), refer to par. 11.12.

② [RECORD ON/OFF] → [ENTRY] key operation is not accept able if printing is turned off by remote contacts when the remote contacts function (option) is added. → See par. 13. 1.

Remarks 2 Execution by pressing [ENTRY] key

①A display of PUSH Entry appears for about 5 seconds when pressing [RECORD ON/OFF] key. By pressing [ENTRY] key during this time, the display disappears and printing on-off operation is executed.

②If [ENTRY] key is not pressed during the display, printing on/off operation is not executed.
Press [RECORD ON/OFF] → [ENTRY] keys again.

③Digital data printing [DATA PRINT] and list printing ([SHIFT] + [9 LIST])are also executed in the same way as described above.

6.3. Fast Feed of Chart/Time Line

1. Fast feed of chart

The chart is fed at a rate of about 10mm/sec when [FEED] key is being pressed. This operation is used for the following purposes.

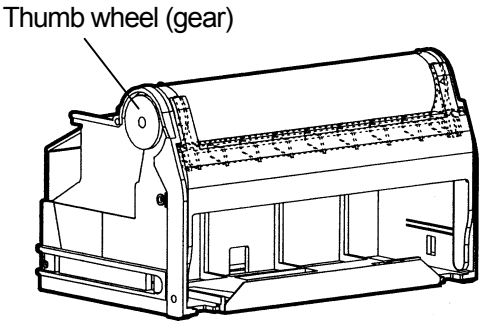
①Setting of time scale line of chart
②Chart feed operation check

Remarks Fast feed condition and operation

1.Condition…..Status display shall be as shown below.
[RECORD ON]…..Illuminates
[KEY LOCK]……..Disappears
2.Operation…..Trace printing (dot-printing) is interrupted during fast feed.

Reference 1 Manual chart feed

Turn the thumb wheel on the left side of the drum after slightly drawing out the chart cassette from the instrument.



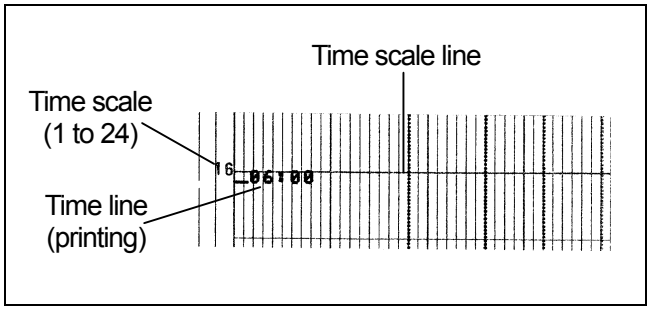
(Note) Even if the time scale line is set by manual chart feed, a delay is produced due to backlash of the gear.

Reference 2 Time scale (1 to 24)

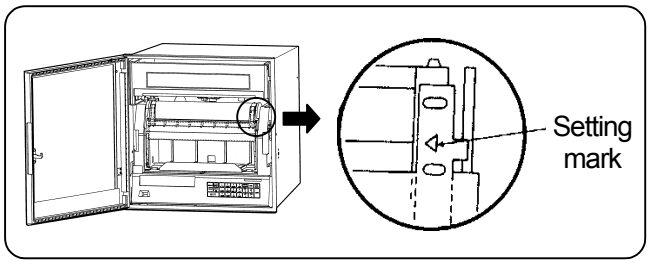
Numeric values 1 to 24 are marked at 25mm intervals on the left side of the chart. This is the time scale when operating the instrument at a chart speed of 25mm/h.

2. Time line setting method

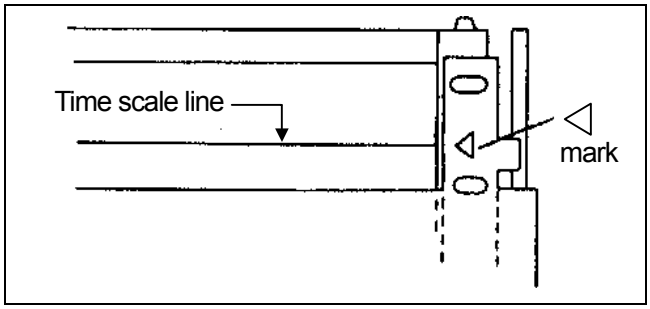
The time line is printed at fixed-time intervals. By setting the time line to the time scale lines of the chart when the chart speed is a multiplier of 25 (mm/ h), the time of trace printing can be read easily. (The following figure shows an example when time lines are not set to the time scale lines of the chart.



1)Time line setting mark(◁)
The time line setting mark(◁)is provided on the right side of the chart guide of the chart cassette.



2) How to set
①Set the time scale line to the ◁ mark as viewed from the front by pressing [FEED] key. (Don't set it by manual turning)
②Turn off printing.
③Turn on printing at a desired time.

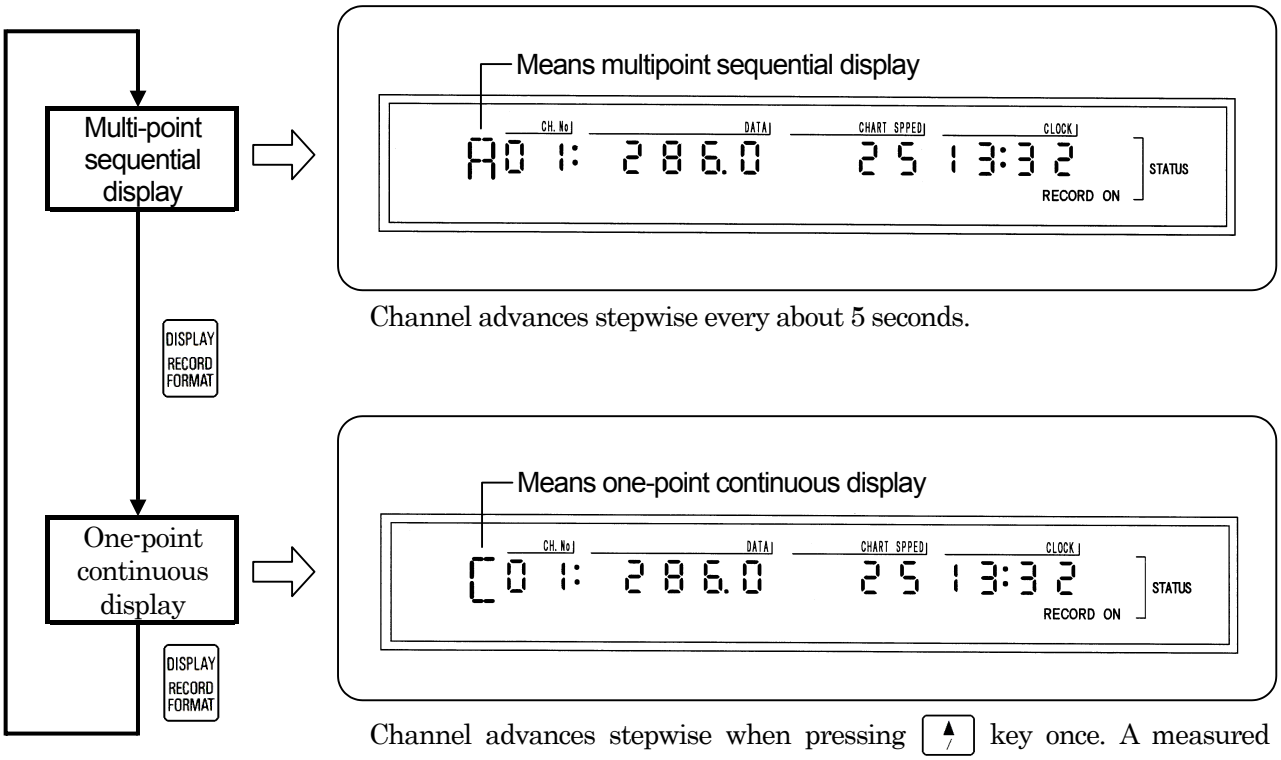


6.4. Selection of Operation Screen

The multipoint sequential display and multipoint simultaneous display are available, and their screens are different from each other.

1. Multipoint sequential display

Two operation display screens are switched from each other, each time [DISPLAY RECORD FORMAT] key is pressed once.
The multipoint sequential display screen is displayed when turning on the power supply.



Channel advances stepwise every about 5 seconds.

Channel advances stepwise when pressing [▲/] key once. A measured value is updated every about 5 seconds.
Channel advances reversely when pressing [▼/%] key once. A measured value is update every about 5 seconds.

2. Multi-point simultaneous display

The display screen differs by the number of measuring points in case of the multi-point simultaneous display.

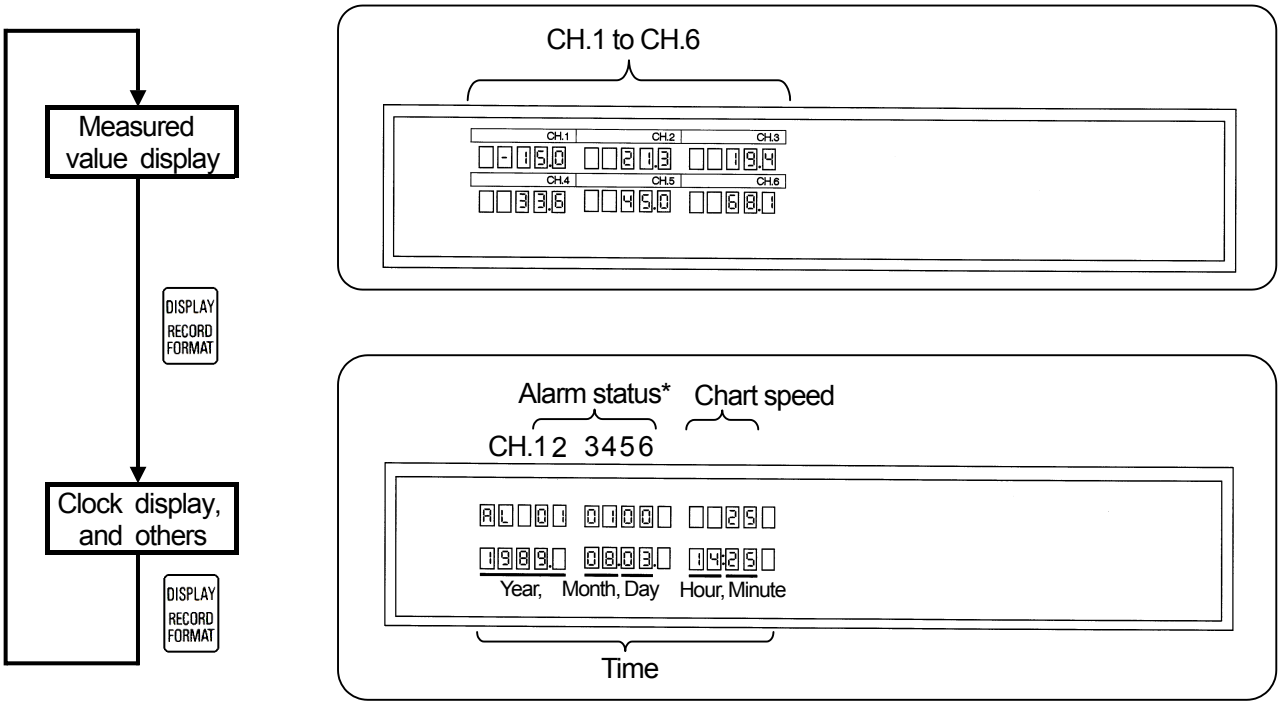
Remarks Decimal point position in measured value display

In upper channels* only of the display, the decimal point lights down to 2 places.
Even if of decimals are programmed in scale programming, no decimal point lights.
Attach 0, if a measured value is less than 1.
<Example> 0052 → 0.052

*Upper channels

6 points		CH. 1 to 3
12 points		CH 1 to 3, CH.7 to 9
24 points	1 to 12	CH.1 to 3, CH.7 to 9
	13 to 24	CH.13 to 15, CH.9 to 21

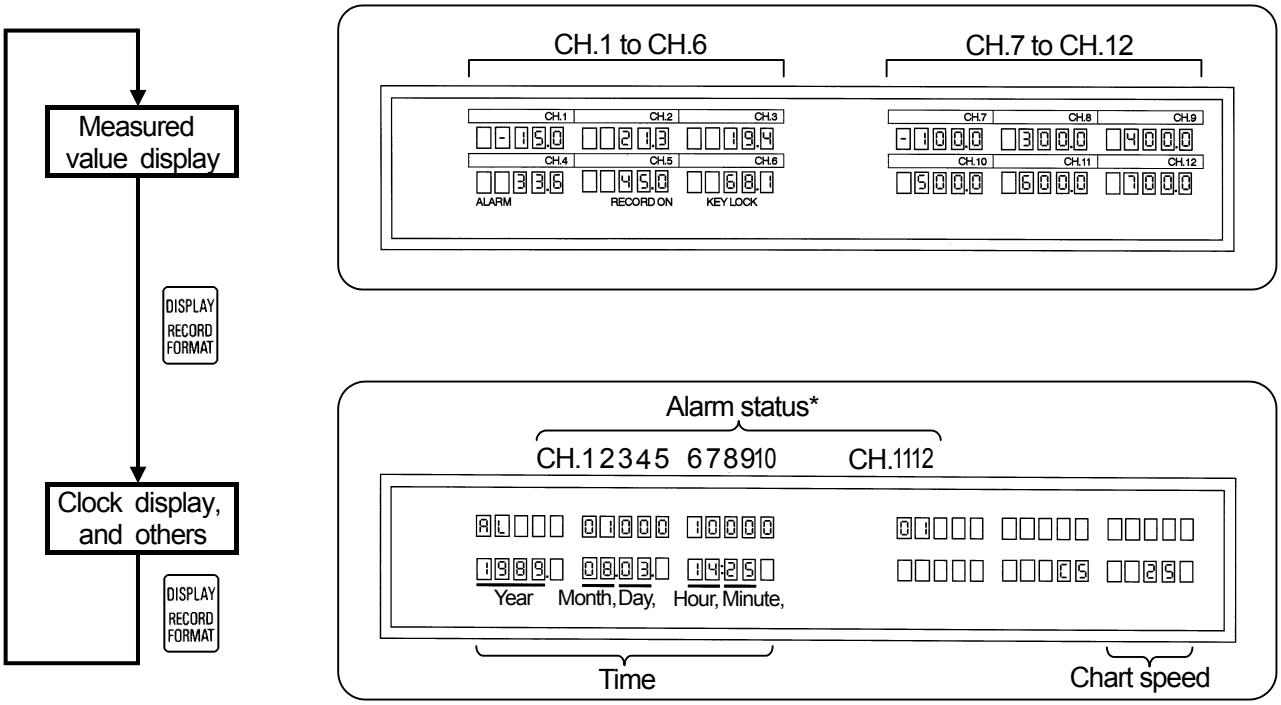
1) 6-point input
The screens of [measured value display] and [clock display, and others] are switched by pressing [Display] key.



*0: Alarm-reset 1: Alarm-on
(The above figure shows that alarm is on in Channels 2 and 4.)

2) 12-point input

The screens of [measured value display] and [clock display, and others] are switched by pressing [Display] key.



*0: Alarm-reset 1: Alarm-on

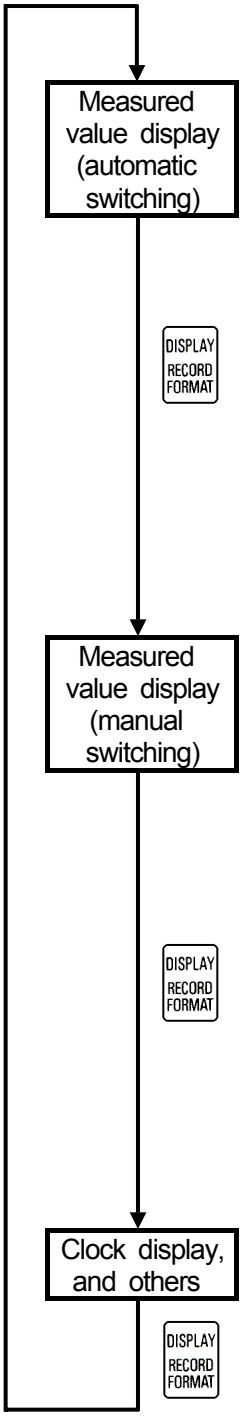
(The above figure shows that alarm is on in Channels 2, 6, and 12.)

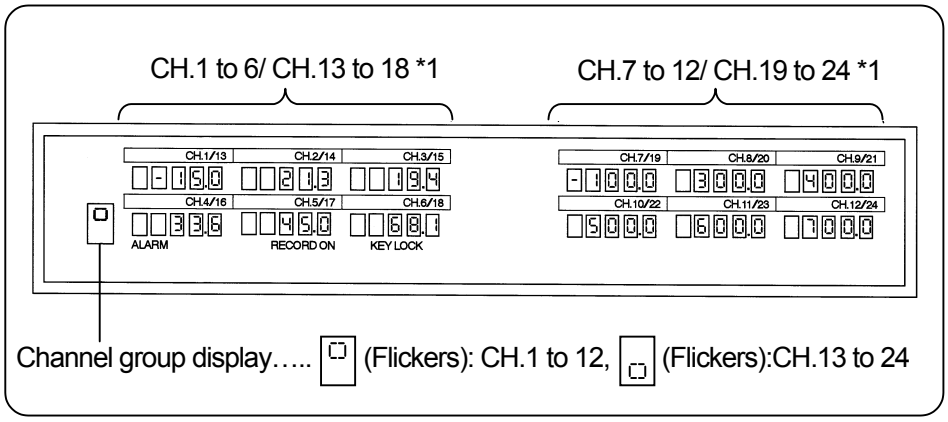
3) 24-point input

①The screen is switched in the order of [Measured value display (auto switching)], [Measured value display (manual switching)], and [Clock display, and others] by pressing [Display] key.

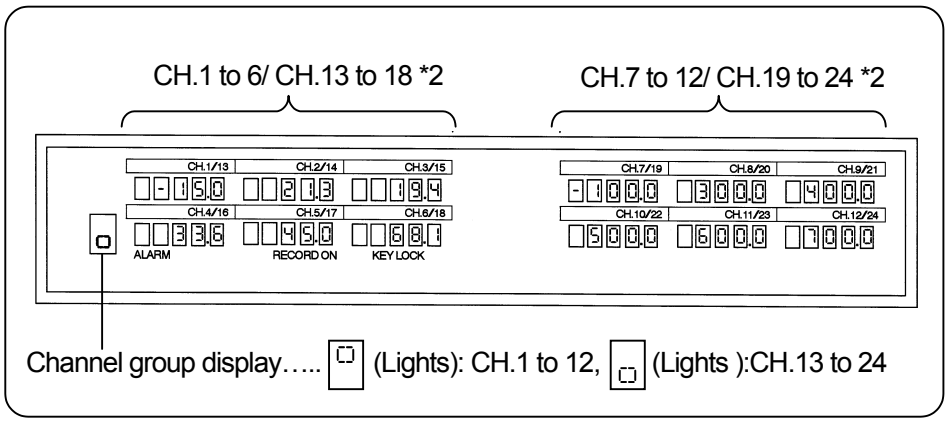
②In case of the automatic group switching of measured value display, the groups of Channels 1 to 12 and Channels 13 to 24 are switched every about 10 seconds.

③In case of the manual group switching of measured value display, the groups of Channels 1 to 12 and Channels 13 to 24 are switched by pressing [▲/] or [▼%] key.

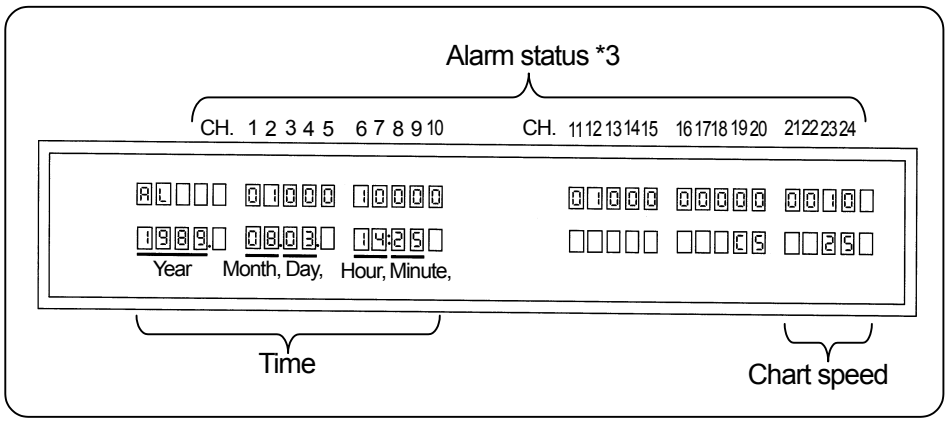




*The groups of Channels 1 to 12 and Channels 13 to 24 are switched every about 10 seconds.



*The groups of Channels 1 to 12 and Channels 13 to 24 are switched by pressing [▲/] or [▼%] key.



*3 0: Alarm-reset 1: Alarm-on

(The above figure shows that alarm is on in Channels 2, 6, 12, and 23.)

7. PROGRAMMING

7.1. Necessity of Programming and Parameters/Functions

1. Necessity of programming

①Various programming parameters are prepared to be able to apply this instrument to versatile uses. Program necessary parameters according to the purposes of uses.

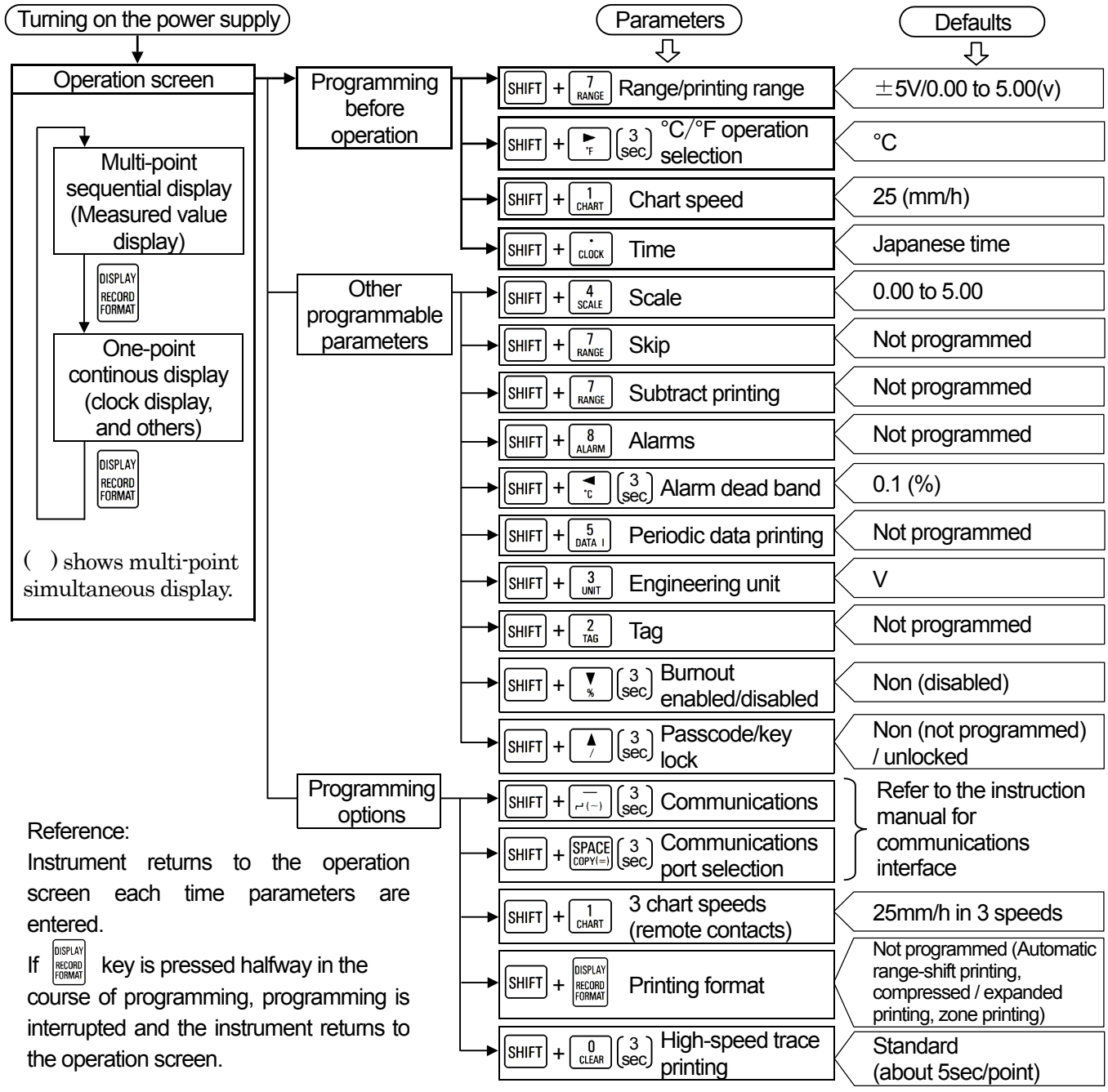
②Program [range/printing range], [°C/°F operation selection], [chart speed], and [time] first.

Major default parameters

Parameters		Defaults
Range/ printing range	Range No.	07(-5.00 to +5.00V)
	Printing range	0.00 to 5.00(V)
°C/°F operation selection		°C
Chart speed		20 (mm/h)

The printing range reflects on the scale. Neither thermocouple range nor resistance thermometer range is necessary when the decimal point position is not changed in programming [scale].

2. From operation screen to various parameters



Reference:

Instrument returns to the operation screen each time parameters are entered.

If DISPLAY RECORD FORMAT key is pressed halfway in the course of programming, programming is interrupted and the instrument returns to the operation screen.

7.2. Default Parameters/Functions and Programming Ranges

1. Parameters to be programmed before operation

Parameters	Programming items	Defaults	Programming ranges	Entry (Note)
Range/ printing range	Range No.	07 (±5V)	01 to 10 (Voltage), 21 to 56 (Thermocouple), 70 to 80 (Resistance thermometer)	SHIFT + SET END
	RJ enabled/ disabled	0 (Disabled)	0 (Disabled), 1 (Enabled, Thermocouple range only)	
	Printing range	0.00 to 5.00	Max. 10 digits (excluding decimal point)	
°C /°F operation selection	—	°C operation	°C, °F operation selection (thermocouple and resistance thermometer ranges only)	ENTRY
Chart speed	—	25(mm/h)	0001 to 1500(mm/h), 1mm step	ENTRY
Time	—	Japanese time	1998. 01. 01. 00:00 to 2097. 12. 31. 23:59	ENTRY

2. Other programmable parameters and functions

Parameters	Programming items	Defaults	Programming ranges		Entry (Note)
Scale	—	0.00 to 5.00	Printing range reflects on the scale. Accordingly, no programming is necessary for thermocouple and resistance thermometer ranges, except for a change of decimal point. Max. 11 digits (excluding decimal point) Lower-limit value* ↵ Higher-limit value* *Within 5 digits		SHIFT + SET END
Skip (deletion and recovery of channel)	—	Not programmed	In the programming of [Range/printing range] Channel to be deleted →Clear the range/printing range. Channel to be recovered →Program the range/printing range.		SHIFT + SET END
Subtract printing (For printing of difference)	—	Not programmed	In the programming of [Range/printing range] Subtract printing channel between channels = Reference channel - subtraction channel Subtract printing channel with reference value = Reference channel - reference value* *Put a decimal point to one place of decimals. (within 5 digits excluding decimal point)		SHIFT + SET END
Alarms 1.Absolute value alarm 2.Rate-of-change alarm 3.Differential alarm	Channel	Not programmed	1 to n, n: Number of channels = 6, 12 or 24		SHIFT + SET END
	Level		1 to 4		
	Alarm types	H	Absolute value	H (Higher-limit), L (Lower-limit)	
			Change-of-ratio	U (Increase-limit), d (Decrease-limit)	
			Defferential	b (Differential higher-limit), S (Differential lower-limit)	
	Output number	00	[00] fixed…Program at optional alarm output only		

Parameters	Programming items	Defaults	Programming ranges		Entry (Note)
Alarms 1.Absolute value alarm 2.Rate-of-change alarm 3.Differential alarm	Alarm value	Not programmed	Absolute value	Max. 5 digits including signs	SHIFT + SET END
			Rate-of-change	Max. 5 digits without sign. Program a change value per [measuring intervals x measuring count].	
			Differential	Max. 5 digits without sign. Program a difference between reference channel and compared channel.	
	Measuring count		Rate-of-change alarm only 1 to 9		
	Channels compared		Differential alarm only 1 to n (Number of channels = 6, 12 or 24)		
Alarm dead band	—	0.1	0.1 to 9.9(%) …of scale width		ENTRY
Periodic data printing	Start time	Not programmed*	00 : 00 to 23 :59 (Hour : Minute)	*Same as in programming initialize	ENTRY
	Interval time	Not programmed*	00H05 (min) Note to 23H59(min) Note) Limited by chart speed		
Engineering unit	—	V *	*Reflected by range number programming, (mV, V, °C,K) Max. 5 digits (Combinations of numeric values, alphabetic characters, %,°C, °F, and space)		SHIFT + SET END
Tag	—	Not programmed	Max. 9 digits (Combinations of numeric values, alphabetic characters, %, /,°C, °F, and space)		SHIFT + SET END
Burnout (enabled/disabled)	—	non	Select non (Burnout is disabled), Up burn (higher-limit burnout) or Down burn (lower-limit burnout)		SHIFT + SET END
Passcode/key lock	Passcode	non	non (Not programmed)/ 0001 to 9999		ENTRY
	Key lock	Unlocked	Select locked or unlocked.		

3. Programming options

Parameters	Programming items	Defaults	Programming ranges	Entry (Note)
Alarm output	Output number	00	Program output numbers at alarm programming 06, 12 or 24 00: No output	SHIFT + SET END
Chart speed 3 speeds (remote contacts)	Speed 1	25	0001 to 1500(mm/h) Note) 3 speeds are selected by remote contacts terminals.	SHIFT + SET END
	Speed 2			
	Speed 3			

Parameters		Programming items	Defaults	Programming ranges	Entry (Note)
Printing format	Automatic range -shift(Ar) (Max. 5 ranges)	Format selection	Sd	Select Ar out of Sd (standard), Ar ,SP, and PL	SHIFT + SET END
		Channel	Not programmed	1 to n, n: Number of channels = 6, 12 or 24	
		Zero of No.1 range		a (Lower-limit value≦a<b)	
		Span of No. 1 range		b(a<b<c)	
		Span of No. 2 range		c(b<c<d)	
		Span of No. 3 range		d(c<d<e)	
		Span of No. 4 range		e(d<e≦f)	
		Span of No. 5 range		f(e<f≦Higher-limit value)	
	Compressed/ expanded printing (SP)	Format selection	Sd	Select SP out of Sd (standard), Ar ,SP, and PL	SHIFT + SET END
		Channel	Not programmed	1 to n, n: Number of channels = 6, 12 or 24	
		Printing position at No. 1 broken point		0 to a (%)	
		Printing position at No. 2 broken point		a to 100 (%)	
		Scale value at 0% position		b (Lower-limit value≦b<c)	
		Scale value at No.1 broken point		c(b<c<d)	
		Scale value at No.2 broken point		d(c<d<e)	
		Scale value at 100% position		e(d<e≦Higher-limit value)	
	Zone printing (PL)	Format selection	Sd	Select PL out of Sd (standard), Ar, SP, and PL	SHIFT + SET END
		Number of area/channels in each area	Not programmed	Number of area = 2 to 4 /Channels are to be specified in each area.	
High-speed trace-printing		—	5 (sec)	Standard (5 sec/point), High speed (2.5 sec/point)	ENTRY

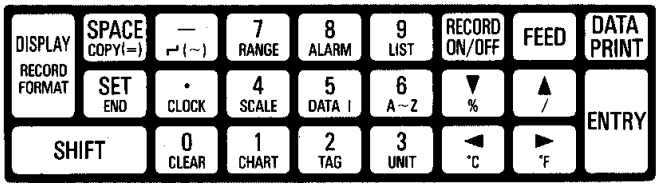
For [communications] and [communications port], refer to the separate instruction manual for [communications interface]

(Note) SHIFT + SET END :Press these keys after pressing ENTRY key (temporary storing) every channel. (Alarm point for Alarm output)

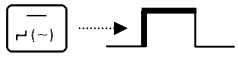
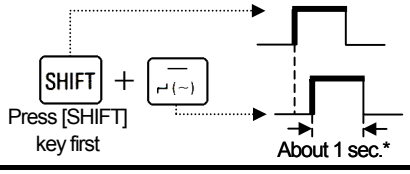
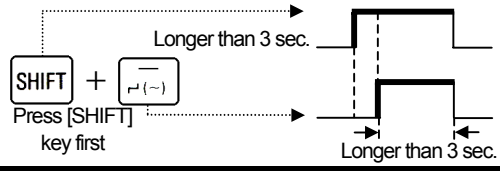
7.3. Programming Keys and Key Operations

1. Keyboard

Lower display functions are operated when pressing these keys together with [SHIFT] key. (Certain keys must be pressed for longer than 3 seconds.)



2. Key operations

①Press independently	②Press together with [SHIFT] key	③Press for longer than 3 seconds together with [SHIFT] key
		

*Release when display has changed. If display has been changed to the other display due to pressing for longer than 3 seconds, press [Display] key, and then execute the operation again.

3. Key functions

1) Keys to be pressed independently

Keys	Names	Functions
DISPLAY RECORD FORMAT	Display	Stops programming and returns to operation display.
SPACE COPY(=)	Space	1. Deletes a numeric or decimal point at an unnecessary digit. 2. Programs "Blank" in [unit] or [tag] programming.
SET END	Program	Changes from programming mode (confirmation of parameters) to programmable condition. The programming lamp of character indicator lights and the cursor appears at the programmable extreme left end.
SHIFT	Shift	Press this key first for using the key functions being indicated on the lower case of each key.
—↵(~) •CLOCK 0 CLEAR 〉 9 LIST	Minus Decimal point 0 9 Numeric values	1. Press these keys for programming a numeric value. 2. For programming a decimal point, shift the cursor to the next digit and press [•CLOCK] key before entering a numeric value. 3. For deleting the decimal point, shift the cursor to the next digit and then, press [SPACE COPY(=)] key.
% /	Down Up	1. Advances the menu or advances it reversely when a menu is programmed selectively. 2. Advances channel number or advances it reversely when parameters are programmed each channel at the programming mode (confirmation of parameters).
°C	Left cursor	Press this key for moving the cursor leftward during programming.
°F	Right cursor	Press this key for moving the cursor rightward during programming.
ENTRY	Entry	Stores new programmed parameters (or selected menu) into EEPROM. The last programmed parameter is deleted. [Range/printing range], [scale] [unit], or other parameters are temporarily stored every channel. For storing them into memory, press [SET END] key together with [SHIFT] key.

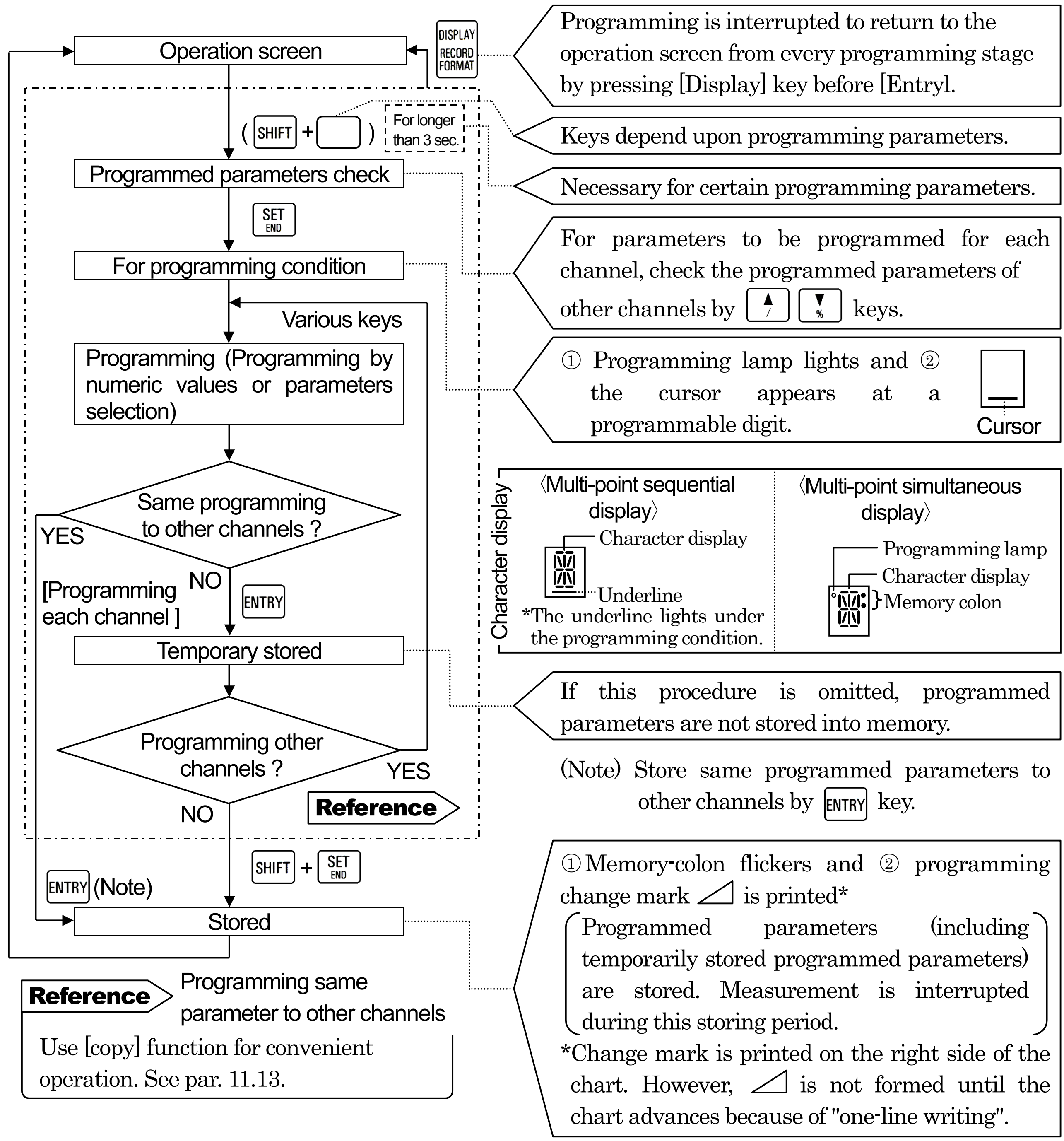
2) Keys to be pressed together with shift key

Keys	Names	Functions
SHIFT + DISPLAY RECORD FORMAT	[Printing format]	The [printing format (option)] programming mode appears. Decimal point appears at the selected mode out of four printing modes*. *4 kinds of Sd (standard), Ar (automatic range-shift), SP (compressed/expanded) and PL (zone)
SHIFT + SPACE COPY(=)	Copy	The copy mode to copy the same programming parameters to other channels appears.
SHIFT + SET END	End	Stores a temporarily stored programmed parameters into EEPROM. This operation is not necessary for parameters (time, chart speed, periodic data printing) common to all channels.
SHIFT + — ↵(~)	To	Inserts data between lower-limit value and higher-limit value when programming [range/printing range], [scale], etc.
SHIFT + • CLOCK	Time	[Time] programming mode appears.
SHIFT + 0 CLEAR	Clear	Clears (blanks) a displaying programmed parameter.
SHIFT + 7 RANGE	[Range/printing range]	[Range/printing range] programming mode appears. [Skip] and [subtract print] can be programmed, too.
SHIFT + 4 SCALE	[Scale]	[Scale] programming mode appears.
SHIFT + 1 CHART	[Chart speed]	[Chart speed] programming mode appears. Sets 3 speeds when external drive function (option) is provided.
SHIFT + 8 ALARM	[Alarm]	[Alarm] programming mode appears.
SHIFT + 5 DATA I	[Periodic data printing]	[Periodic data printing] programming mode appears.
SHIFT + 2 TAG	[Tag]	[Tag] programming mode appears.
SHIFT + 6 A~Z	Alphabetic characters	Press these keys for programming an alphabetic character in [engineering unit] or [tag] programming. Characters advance in the order of A, B, C…..when pressing ▲ key or they advance reversely when pressing ▼ key.
SHIFT + 3 UNIT	[Engineering unit]	[Engineering unit] programming mode appears.
SHIFT + ▼ %	Percent character	[%] character in [unit] or [tag] programming.
SHIFT + ▲ /	Slash /=	[/] character in [unit] or [tag] programming or [=] in subtract printing.
SHIFT + ◄ °C	°C character	[°C] character (2 digits) in [unit] or [tag] programming.
SHIFT + ► °F	°F character	[°F] character (2 digits) in [unit] or [tag] programming.
SHIFT + — ↵(~) (for longer than 3 sec.)	[Communications]	[Communications] programming mode appears. (when communications is added – option)
SHIFT + SPACE COPY(=) (for longer than 3 sec.)	[Communications port selection]	[Communication port selection] programming mode appears. (when communications is added – option)
SHIFT + ◄ °C (for longer than 3 sec.)	[Alarm dead band]	[Alarm dead band] programming mode appears.
SHIFT + ► °F (for longer than 3 sec.)	[°C /°F operation selection]	[°C /°F operation selection] programming mode appears. (Effective for thermocouple or resistance thermometer range only)
SHIFT + ▼ % (for longer than 3 sec.)	[Burnout enabled/ disabled]	[Burnout] programming mode appears. (Effective for thermocouple or resistance thermometer range only)
SHIFT + ▲ / (for longer than 3 sec.)	[Passcode/ key lock]	[Passcode/key lock] programming mode appears.
SHIFT + 0 CLEAR (for longer than 3 sec.)	[High-speed trace printing]	[High-speed trace printing] programming mode appears. (when high-speed trace printing is added – option)

7.4. Programming Procedures

This paragraph shows the basic programming parameters. In case of multi-point simultaneous display, the lower left side shows the programming display.

1. Basis of programming flow chart

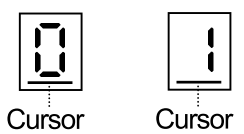


3. Key operation

1) Numeric keys and cursor
   Cursor shifts rightward when pressing numeric keys ([0 CLEAR] to [9 LIST] , [−])
   Press cursor keys ([▶ °F] [◀ °C]) for moving the cursor.
2) How to add or delete decimal point
   For adding the decimal point, move the cursor to □.□ and press [• CLOCK] .
   For deleting the decimal point, press [SPACE COPY(=)] key. (Numeric is also deleted)
3) Clearing a displayed programmed parameter
   The programmed parameter is cleared by pressing [SHIFT] + [0 CLEAR] keys

Channel programming

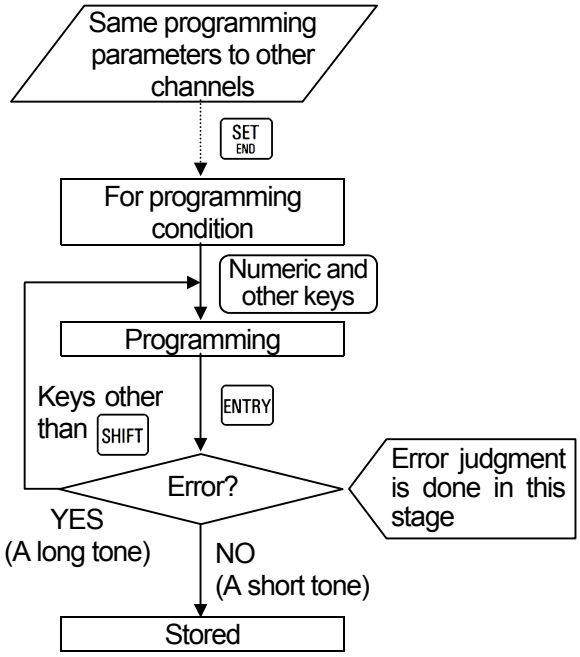
Program a channel by 2 digits. Cursors appear in 2 digits.

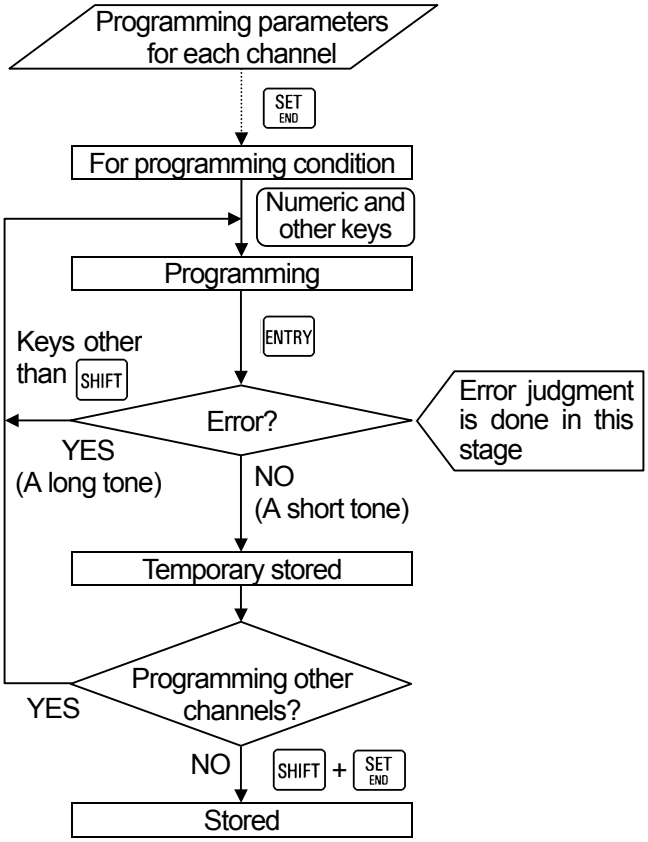


7.5. Programming Errors and Remedial Measures

The instrument judges if a programmed parameter is free of an error when pressing [ENTRY] key in the [storing] or [temporary storing] procedure.

1. Error judgment flow chart





2. Kinds of errors and error display

If a programmed parameter is wrong, a short tone (about 0.5 second) sounds and no storing (or temporary storing) is done.

Kinds of error	Format error	Programming error
Contents	A programmed parameter format is in error. [1234] was programmed to [12-34] or the like, for example.	A numeric out of the programming range was programmed.
Display	Programmed value…… Flickers F.E *…… Flickers	Programmed value…….. Flickers S.E *…….. Flickers

*In case of multi-point simultaneous display, the upper display becomes "For Error" or "Set Error".

3. Remedial measures in the occurrence of an error

If a key other than [SHIFT] key is pressed, flickering stops and the cursor appears to be ready for reprogramming.
Program a correct parameter again.

8. BASIC PROGRAMMING

8.1. Parameters to be Programmed Before Operation

Certain parameters are to be programmed for starting operation after turning on the power supply.

1. Turning on the power supply

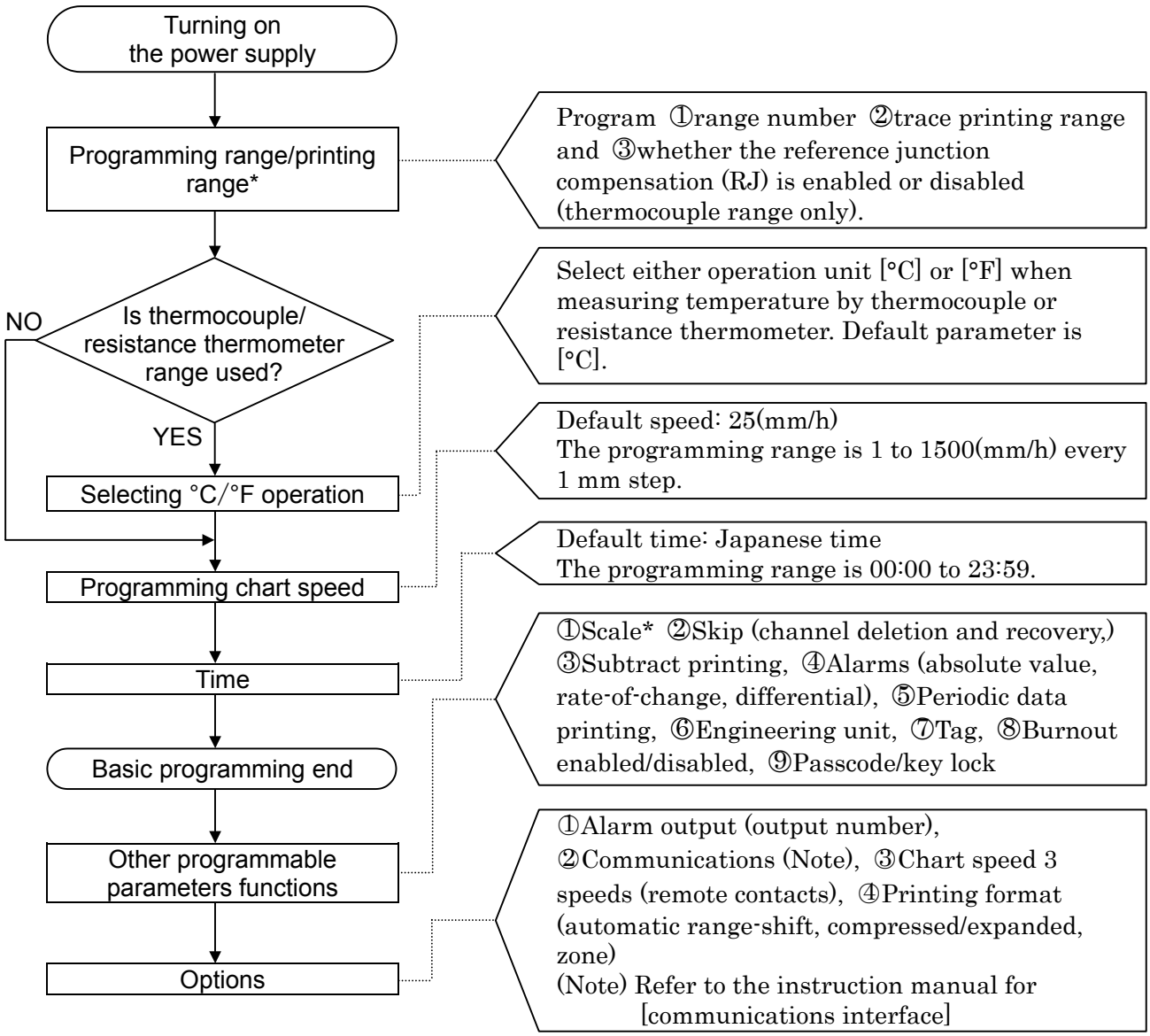
By turning on the power supply for the first time, the display and printing operation are started with default parameters.

Default parameters

Range/printing range	07 (±5V) /0.00 to 5.00 (V)
°C/°F operation selection	°C operation
Chart speed	25 (mm/h)
Time	Japanese time

2. Basic programming parameters

Program the following parameters before operation.



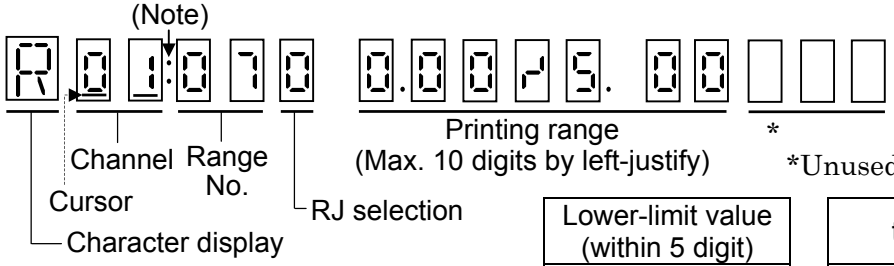
*The [scale] is reflected by the printing range programming. For scaling of voltage input, read par. 11.2.

8.2. Range/Printing Range

Program the following parameters before operation. By pressing SHIFT + 7 RANGE keys under the operation screen, the [range/printing range] programming display appears. Program these parameters for each channel.

1. Programming mode and parameters

1) Programming mode



(Note) No colon display appears in multi-point simultaneous display.

*Unused digit are filled with spaces.

Lower-limit value (within 5 digit)	to	Upper-limit value (within 5 digit)
Input-value to print 0%	SHIFT + (−)	Input-value to print 100%

2) Parameters

Program the following three parameters every channel.

Parameters	①Range No.	②RJ selection	③Printing range
Purpose	Selection of the input types and measuring ranges.	Decision whether the reference junction compensation (RJ) function is enabled or disabled.	Decision of the input range to be printed on the chart.
Programming values	Range number (2-digit numeric value) For range number list, see par. 4.	0: Disabled (exterior) 1: Enabled (interior) Program 0 for all inputs other than thermocouple input.	Lower-limit value to higher-limit value (within 5 digits each) This programming can be done irrespective of the measuring range being selected in range number. See (Caution)

(Caution) Printing an input exceeding the measuring range or printing range causes an over-range (overshooting).

2. Cautions on programming and reference

Be careful with the following cautions and reference items. Refer to the programming flow chart on the next page.

1) Minimum printing range

Read the minimum printing range in par. 20.1 (Input specifications). A programming error occurs if the lower-limit value is equal to the higher limit value.

2) Decimal places

The [scale] is reflected by the printing range. The decimal point position on actual display / printing is fixed by range number. For change, refer to [scale] programming.

Range No. (measuring range)	Printing range	Scale	Actual position
07(-5.00 to +5.00V)	0 to 5	0 to 5	0.00 to 5.00
21(-200.0 to +300.0°C)	0 to 200	0 to 200	0.0 to 200.0
23(-200 to +1370°C)	0.0 to 800.0	0.0 to 800.0	0 to 800

3) If range/printing range is changed, the last scale becomes ineffective and the new printing range serves as the scale.

4) Subtract printing channel

For subtract printing, the range programming method differs. Refer to par.11.4 (Subtract printing programming)

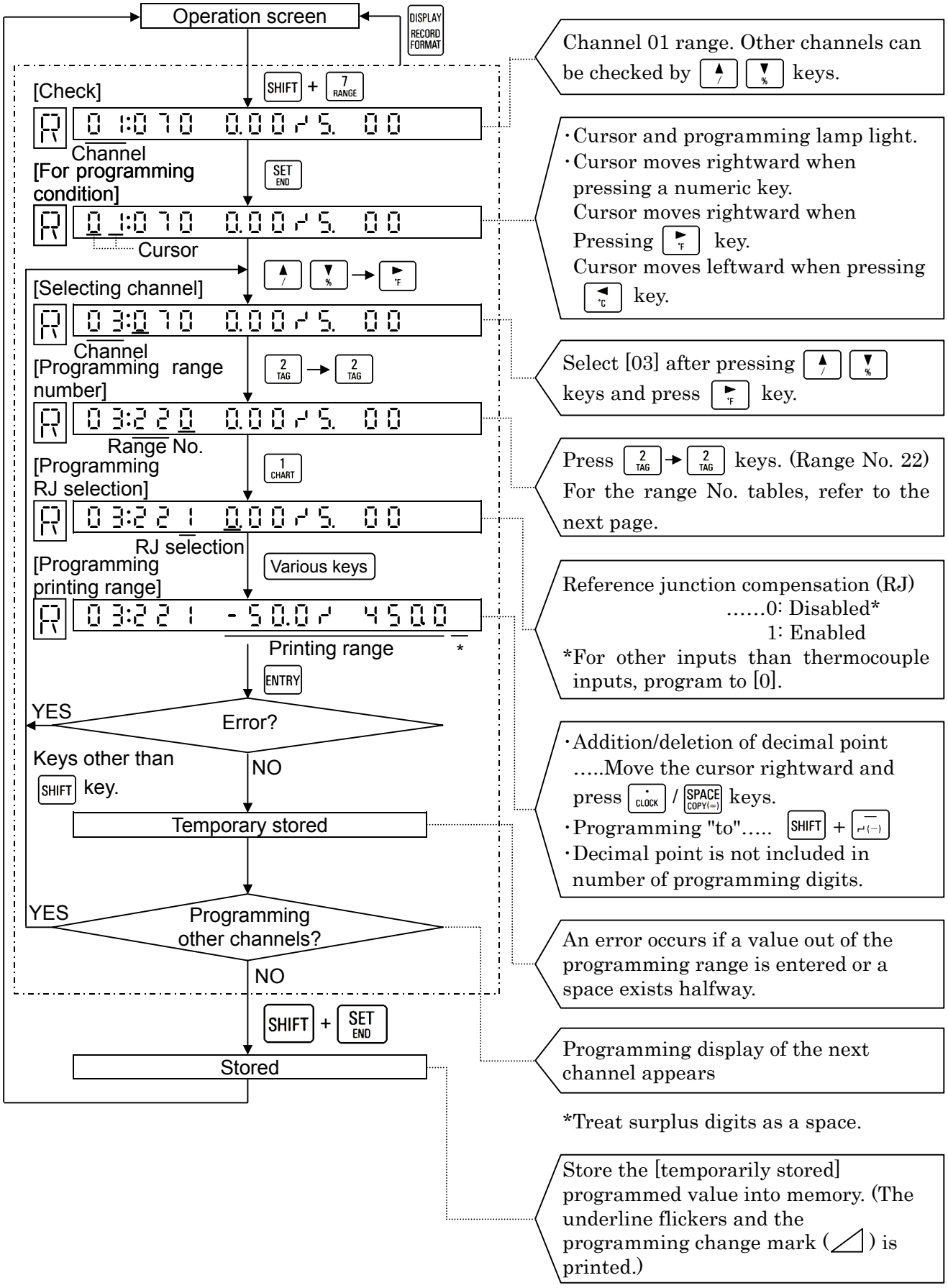
5) For programming the same range to other channels. The [copy] function is conveniend. Refer to par. 11.13.

6) Scaling

The printing range reflects on [scale]. For optional scaling to a channel where the voltage range is programmed, read par.11.2 and program the [scale].

3. Programming flow chart

<Example> Range number of channel 03 is 22, the reference junction compensation function (RJ) is used, and the printing range is set to -50 to +450°C , for example.



4. Range No. Tables

1) Voltage input

No.	Input type	Measuring range	Remarks
01	DC (mV)	-13.80 to 13.80mV	For current input, see Item 15.2.
02		-27.60 to 27.60mV	
03		-69.00 to 69.00mV	
04		-200.0 to 200.0mV	
05		-500.0 to 500.0mV	
06	DC (V)	-2.00 to 2.00 V	
07		-5.00 to 5.00 V	
08		-10.00 to 10.00 V	
09		-20.00 to 20.00 V	
10		-50.00 to 50.00 V	

2) Thermocouple input (*1)

No.	Input type	Measuring range	
		°C	°F
21	K	-200.0 to 300.0	-320.0 to 570.0
22		-200.0 to 600.0	-320 to 1110
23		-200 to 1370	-320 to 2490
24	E	-200.0 to 200.0	-320.0 to 390.0
25		-200.0 to 350.0	-320.0 to 660.0
26		-200 to 900	-320 to 1650
27	J	-200.0 to 250.0	-320.0 to 480.0
28		-200.0 to 500.0	-320.0 to 930.0
29		-200 to 1200	-320 to 2190
30	T	-200.0 to 250.0	-320.0 to 480.0
31		-200.0 to 400.0	-320.0 to 750.0
32	R	0 to 1200	32 to 2190
33		0 to 1760	32 to 3200
34	S	0 to 1300	32 to 2370
35		0 to 1760	32 to 3200
36	B	0 to 1820	32 to 3300
37	N	-200.0 to 400.0	-320.0 to 750.0
38		-200.0 to 750.0	-320 to 1380
39		-200 to 1300	-320 to 2370
40	W-WRe26	0 to 2315	32 to 4200
41	WRe5-WRe26	0 to 2315	32 to 4200
43	PtRh40-PtRh20	0 to 1888	32 to 3400
44	NiMo-Ni	-50.0 to 290.0	32.0 to 550.0
45		-50.0 to 600.0	32 to 1110
46		50 to 1310	32 to 2350
47	CR-AuFe	0.0 to 280.0K	0.0 to 300.0K
48	Platinel II	0.0 to 350.0	-140.0 to 660.0
49		0.0 to 650.0	-140 to 1200
50		0 to 1390	-140 to 2530
51	U	-200.0 to 250.0	-320.0 to 480.0
52		-200.0 to 500.0	-320.0 to 930.0
53		-200.0 to 600.0	-320 to 1110
54	L	-200.0 to 250.0	-320.0 to 480.0
55		-200.0 to 500.0	-320.0 to 930.0
56		-200 to 900	-320 to 1650

3) Resistance thermometer input (*2)

No.	Input type	Measuring range	
		°C	°F
70	Pt100 (JIS'97)	-140.0 to 150.0	-220.0 to 300.0
71		-200.0 to 300.0	-320.0 to 550.0
72		-200.0 to 850.0	-320 to 1560
73	Pt100 (QPt100 JIS'89)	-140.0 to 150.0	-220.0 to 300.0
74		-200.0 to 300.0	-320.0 to 550.0
75		-200.0 to 649.0	-320 to 1200
76	JPt100	-140.0 to 150.0	-220.0 to 300.0
77		-200.0 to 300.0	-320.0 to 550.0
78		-200.0 to 649.0	-320 to 1200
79	Pt50	-200.0 to 649.0	-320 to 1200
80	Pt-Co	4.0 to 374.0K	4.0 to 374.0K

*1:(1) No. 21 to 39:IEC 584,JIS C 1602-1995
(2) No. 40 to 50:ASTM
(3) No. 51 to 56:DIN43710

*2:(1) No. 70 to 72:IEC751(1995), JIS C 1604-1997
(2) No. 73 to 75:IEC751(1983), JIS C 1604-1989, JIS C 1606-1989
(3) No. 76 to 78:JIS C 1604-1981, JIS C 1606-1989
(4) No. 79:JIS C 1604-1981

Remarks Decimal point position and engineering units

Decimal point position: Even if the decimal point position is programmed in the printing range, the actual display/printing position is shown as described in the table above depending on the range No. For changing the decimal point position, see Section 11.2 "Scale programming".

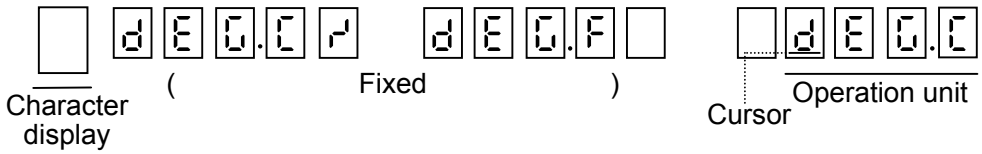
Engineering units: Engineering unit is shown as described in the table above depending on range No. (Temperature unit is fixed to "°C" except No. 47 and 80). For changing the engineering unit, see Section 11.8 "Unit programming".

8.3. °C/°F Operation Selection

This program is to select [°C] or [°F] operation for the use of temperature range (thermocouple or resistance thermometer). The default is [°C] operation.

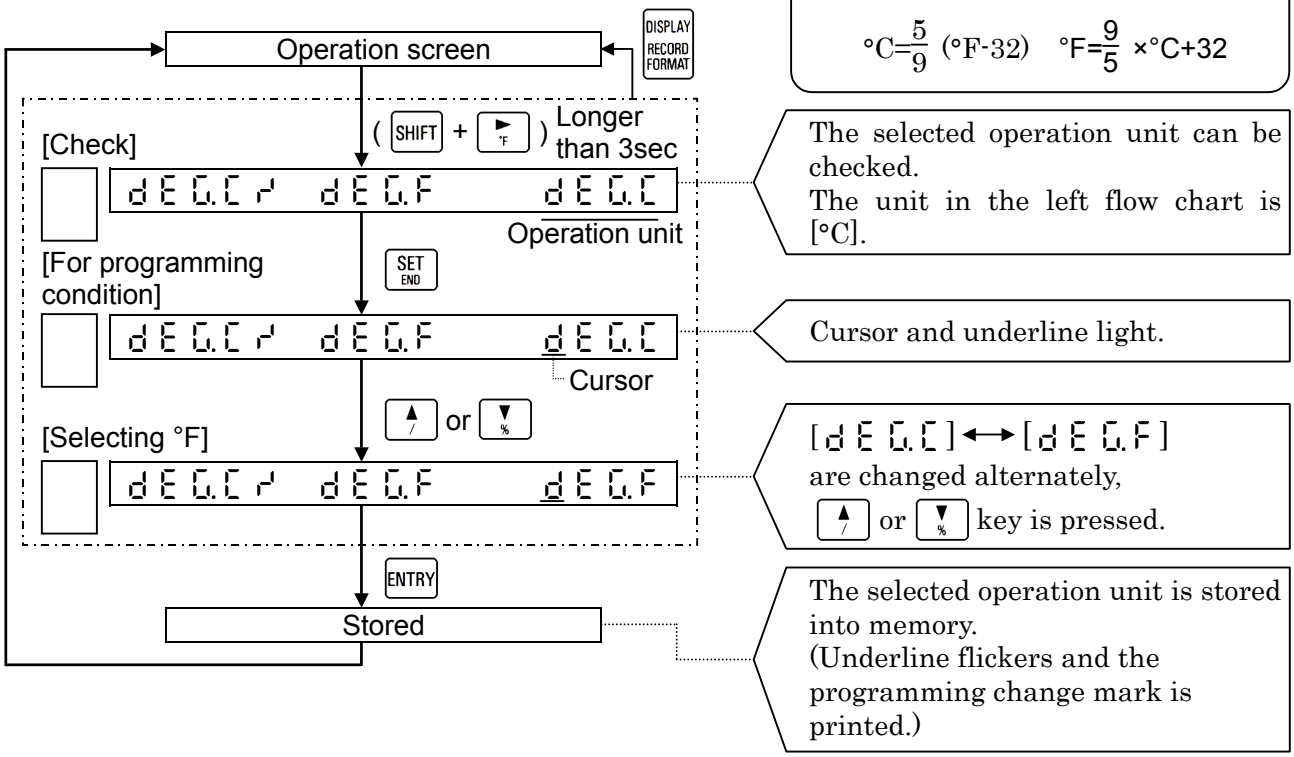
By pressing [SHIFT] + [→°F] keys for longer than 3 seconds from operation screen, the [°C/°F operation] selection display appears.

1. Programming mode



2. Programming flow chart

<Example> [°C] operation ⟶ [°F] operation



Reference Relation with other programming contents

1) In case of temperature unit [K]
The unit of range No. 47 (AuFe-CR) and No. 80 (Pt-Co) is [K], and it does not affect this programming.

2) Influence onto other programmed parameters
Programmed parameters of [range/printing range], [scale], [alarm value], etc. don't change automatically.
Reprogram the parameters if they cannot be used as the parameters for the selected operation unit. The operation is not switched even if °C or °F is selected by [engineering unit] programming.

8.4. Chart Speed

Program the chart speed before operation.

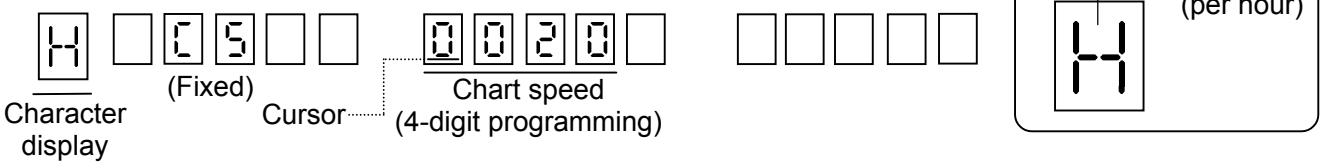
・By pressing [SHIFT] + [1 CHART] keys in the operation screen, the [chart speed] programming display appears.

・For remote contacts (option), refer to par. 13.2.

Default speed and programming range

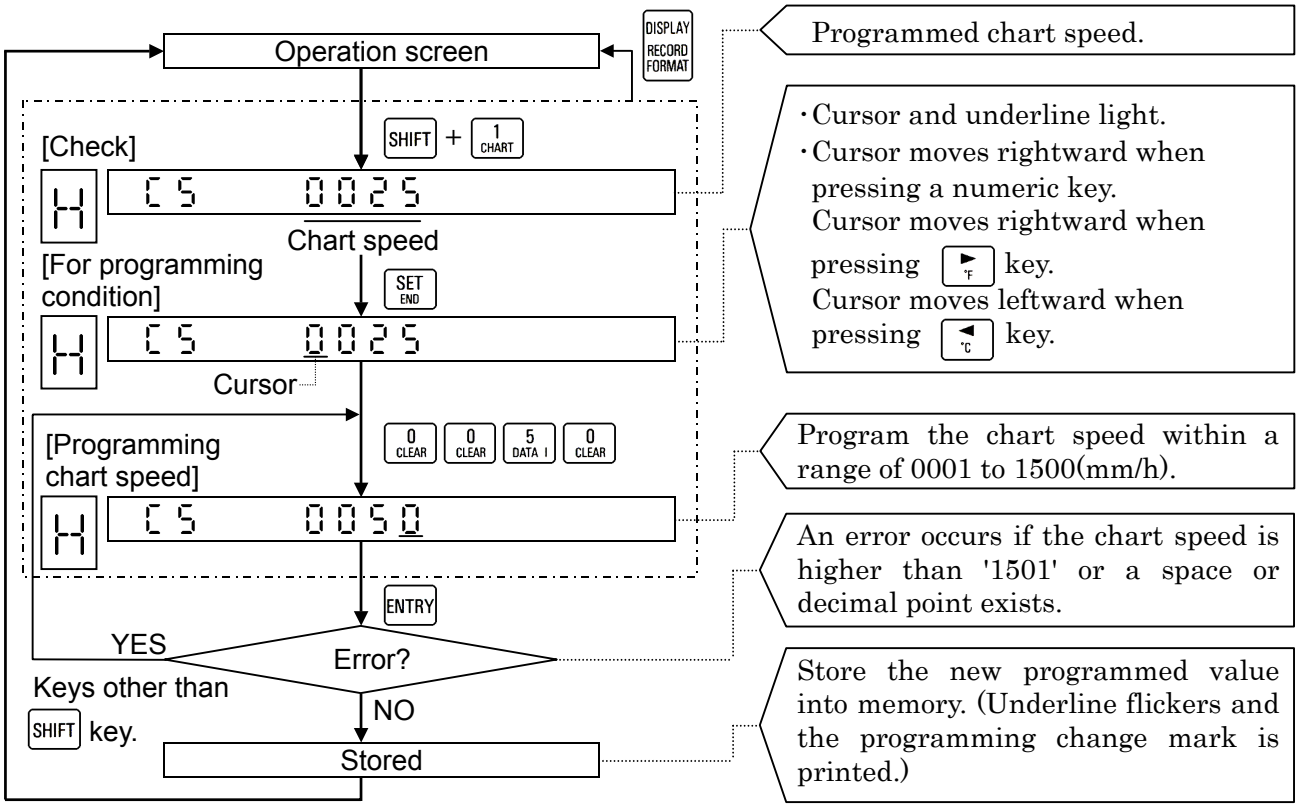
Default	:0025	(mm/h)
Programming range	:0001 to 1500	(mm/h)

1. Programming mode



2. Programming flow chart

<Example> 25(mm/h) ⟶ 50(mm/h)



Remarks 1

No printing is done if the chart speed is programmed to be faster than 251 (mm/h). (Refer to par. 10.2.)

Remarks 2 Influence to periodic data printing

When changing the chart speed, programmed parameters of [periodic data printing] (par.11. 7) is cleared.
(Default: Not programmed)

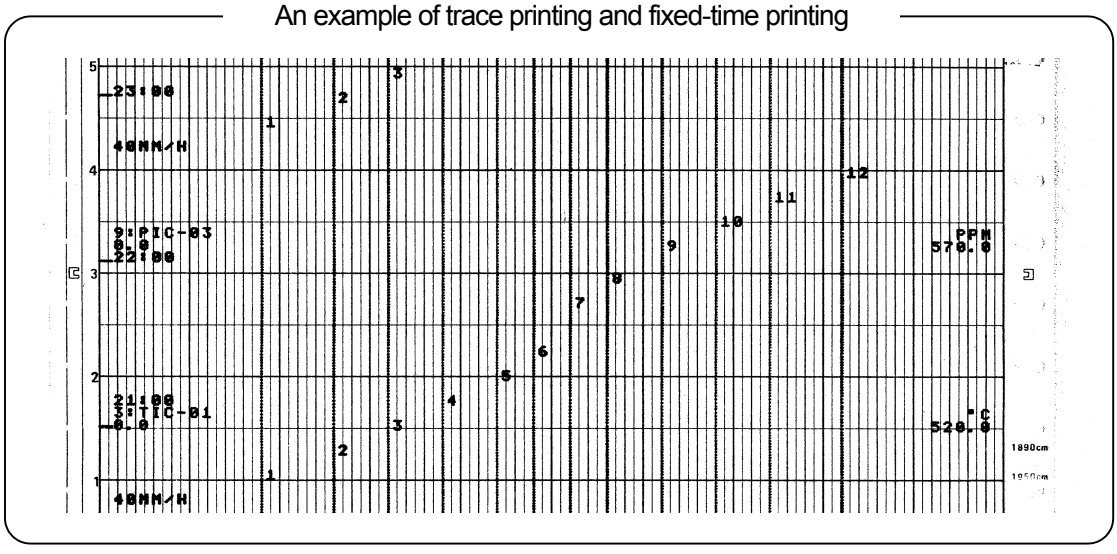
9. PRINTINGS

9.1. Printings

Printing comprises trace printing and digital printing. Trace printing, channel number printing, and fixed-time printing are carried out even if no programming is done.

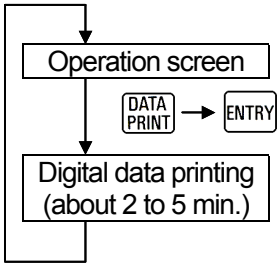
<table>
<tr><th colspan="2">Printings</th><th>Printing contents</th><th>Remarks</th></tr>
<tr><td colspan="2">Trace printing
(Dot-printing)</td><td>Trace printing is executed by dot-printing by colors every channel. The following table shows channel colors.
<table>
<tr><td>CH.</td><td>1,7,13,19</td><td>2,8,14,20</td><td>3,9,15,21</td><td>4,10,16,22</td><td>5,11,17,23</td><td>6,12,18,24</td></tr>
<tr><td>Color</td><td>Red</td><td>Black</td><td>Blue</td><td>Green</td><td>Brown</td><td>Purple</td></tr>
</table></td><td></td></tr>
<tr><td rowspan="8">Digital printing</td><td>Channel number printing</td><td>Channel number is printed every fixed-time beside trace printing</td><td>For the printing cycle, refer to par. 10.1.</td></tr>
<tr><td>Fixed-time printing</td><td>The following printing is executed every fixed-time. ① Time line, ②Time, ③Chart speed, ④Tag, engineering unit, scale ⑤ Year, month, day</td><td>For the printing cycle, refer to par. 10. 1</td></tr>
<tr><td>Digital data printing</td><td>Data (measured values) at the requested time are printed by interrupting trace printing.</td><td>[DATA PRINT] → [ENTRY]
Refer to par. 9.2.</td></tr>
<tr><td>List printing</td><td>Various programmed parameters are printed in the format of a table.</td><td>[SHIFT] + [9 LIST] → [ENTRY]
Refer to par. 9.3.</td></tr>
<tr><td>Periodic data printing</td><td>Data (measured values) are printed on trace printing at programmed intervals.</td><td>Programming [periodic data printing]. Refer to par. 11.7.</td></tr>
<tr><td>Alarm printing</td><td>Time, alarm points, etc. are printed when an alarm is on or reset.</td><td>Refer to par. 10.4.</td></tr>
<tr><td>Programming change mark printing</td><td>Mark ◿ is printed when the parameter is changed and stored.</td><td>Key operation for [storing]</td></tr>
<tr><td>Power-on printing</td><td>Year/month.day/time is printed only when power supply is turned on.</td><td>When the power supply is turned on.</td></tr>
</table>

An example of trace printing and fixed-time printing



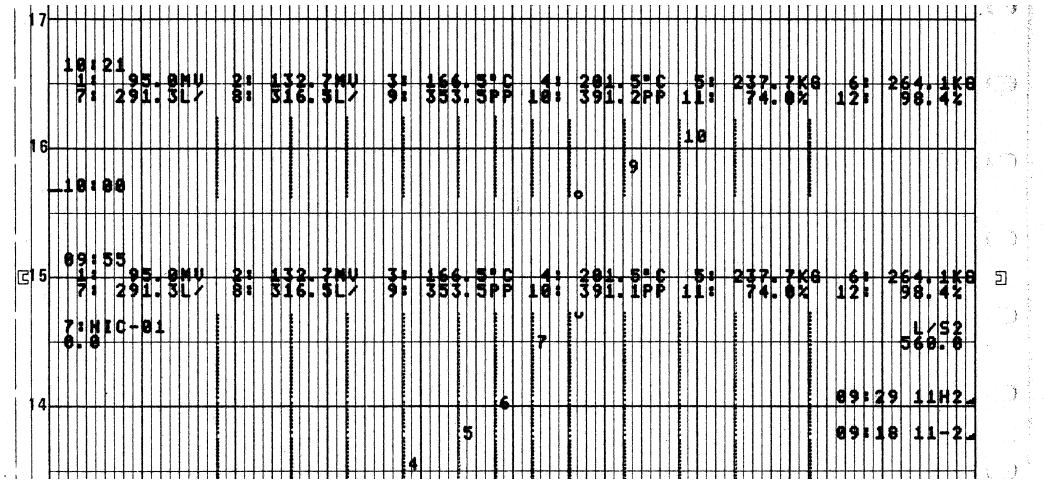
9.2. Digital Data Printing

Measured values are digitally printed at the requested time, but trace printing is interrupted.



①Press DATA PRINT → ENTRY keys. **Remarks 2**
②Trace printing (dot-printing) is interrupted and the chart is fed a little.
③The measured values at the time pressing keys are printed.
④After the end, the chart is fed a little, and the instrument returns to the condition before execution.
⑤Printing colors change in the order of
red → black → blue → green → brown → purple.

An example of digital data printing



Remarks 1 Digital data printing cannot be executed in the following cases.

①RECORD ON status disappears.
②KEY LOCK status illuminates.

Remarks 2 Digital data printing is executed by pressing ENTRY key.

①By pressing DATA PRINT key, PUSH Entry is displayed for about 5 seconds. Data are printed by pressing ENTRY key during this display time.

②If ENTRY key is not pressed during this display time, data are not printed.
Press DATA PRINT → ENTRY keys again.

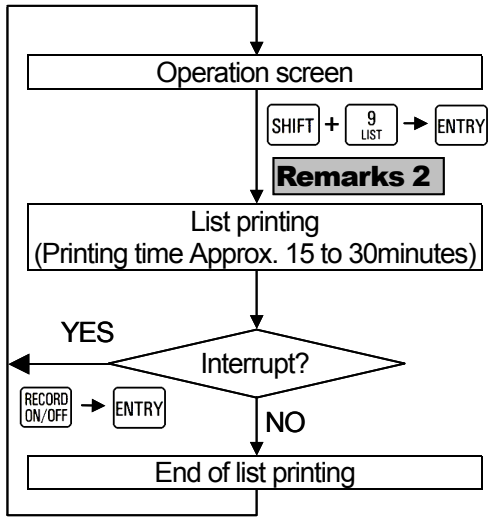
Reference Printing operation and stop

Operation…..Measurement and alarm operation are continued without being interrupted.

Interruption….For interrupting, press RECORD ON/OFF → ENTRY keys.
One line during printing ends and the printing stops.
Then, the instrument returns to the last printing condition when pressing RECORD ON/OFF → ENTRY key.

9.3. List Printing

Programmed parameters of [range/printing range], [scale], [chart speed], etc. can be printed, but trace printing is interrupted.



Remarks 1 List printing cannot be executed in the following cases.

①RECORD ON status disappears.
②KEY LOCK status illuminates.

Remarks 2 List printing is executed by pressing ENTRY key.

①By pressing SHIFT + 9 LIST key,

PUSH Entry is displayed for about 5 seconds. Data are printed by pressing ENTRY key during this display time.

②If ENTRY key is not pressed during this display time, data are not printed.
Press SHIFT + 9 LIST → ENTRY keys again.

Reference Operation in printing

Operation….Measurement and alarm operation are continued without being interrupted.

①Press SHIFT + 9 LIST → ENTRY keys.
Trace printing is interrupted. Chart is fed slightly and list printing is started.

②After the end, the chart is fed a little, and the instrument returns to the condition before execution.

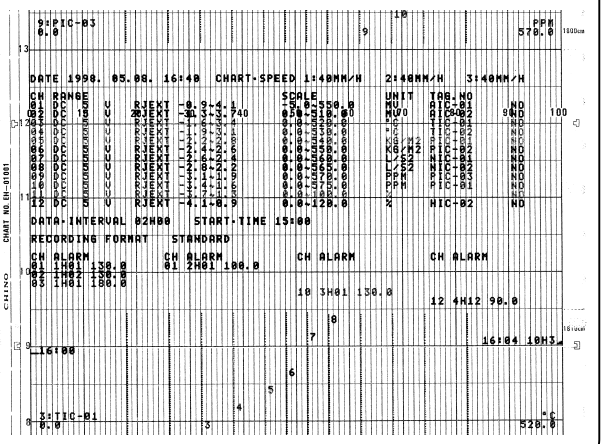
③For interrupting the operation,
press RECORD ON/OFF → ENTRY keys and turn on the printing by pressing RECORD ON/OFF → ENTRY keys again.

④ Printing color is black. The programmed parameters of each channel are printed with the same colors as in trace printing.

List printing

①Year/month, day/hour/minute
②Chart speed
③Range of each channel (Input type, measuring range, whether reference junction compensation enabled or disabled (inside/outside), printing range)
④Scale, engineering unit, and tag in each channel*
⑤ Periodic data printing (interval, start time)*
⑥Printing format
⑦Alarms
*These parameters are not printed if they are not programmed.

An example of list printing



9.4. Programming Printing Formats

This programming is for the instrument with a printing format function (option) only. Trace printing formats can be selected.

Kinds of format and programming

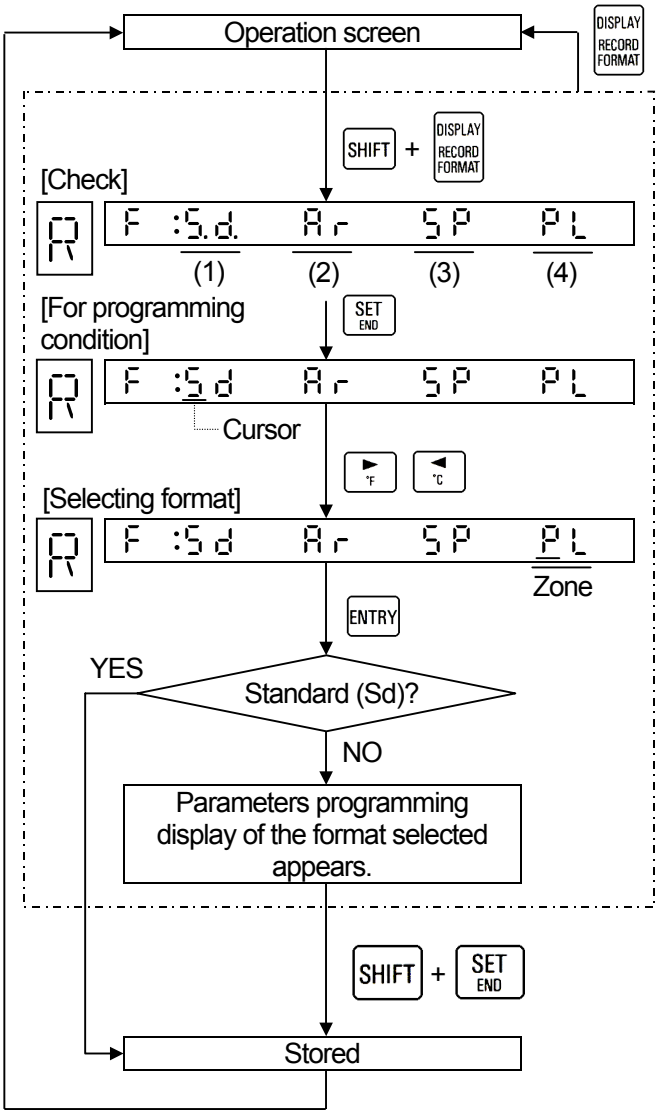
Kinds	Programming
①Standard(Sd)	Not required
②Automatic range-shift(Ar)	Par. 14.1
③Compressed/expanded(SP)	Par. 14.2
④Zone(PL)	Par. 14.3

1. Kinds of printing formats

Select a desired format in advance. The default format is standard (Sd).

2. Selection flow chart

<Example> Standard printing ⟶ zone printing



Reference 1 Printing format check

Dots appear in the current format.
(1) Sd. : Standard
(2) Ar. : Automatic range-shift
(3) SP. : Compressed/expanded
(4) PL. : Zone

Reference 2 [Storing] method

1. When the standard format is selected;
   The selected format is stored by pressing ENTRY key.
2. When a format other than the standard format is selected;
   The selected format is stored by pressing SHIFT + SET END keys after pressing ENTRY key.

Reference 3 Storing

The selected format is stored into memory. Trace printing is executed on the stored format. (Programming change mark is printed.)

10. OPERATIONS

10.1. Fixed-Time Printing Intervals

Fixed-time printing is started after turning on the power supply. The following table shows an outline of the intervals according to the printing contents.

Time and time line	Channel number	Chart speed	Scale, tag, engineering unit
Depends upon chart speed	In the order of channel number at about 6mm intervals	About 84mm intervals	In the order of channels at printing intervals of channel numbers.

1. Printing intervals of time and time lines

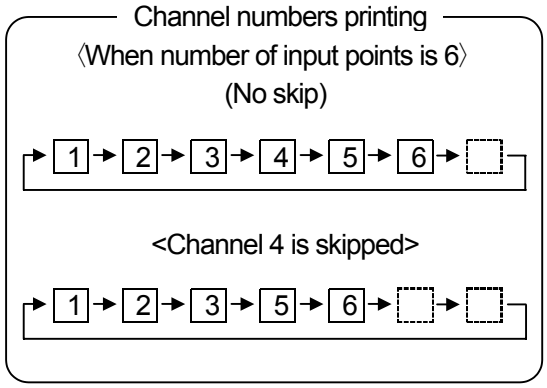
Printing is interlocked with the chart speed and carried out at the following intervals. The start point of intervals is 00: 00 hours.

Chart speed	Time, time line (Note)	Time line only	Year, month, day
1 to 9	12:00 hours only	6 hours	00:00 hours only
10 to 15	4 hours	2 hours	
16 to 30	2 hours	1 hour	
31 to 60	1 hour	←	
61 to 119	1 hour	30 minutes	
120 or over	30 minutes	←	

(Note) Time lines only are printed if this printing overlaps with periodic data printing.

2. Printing intervals of channel numbers

①Fixed-time printing is executed besides trace printing (See note) with the same colors as trace printing in the order of channel numbers at intervals of about 6mm.
(Note) Left side when printing is impossible on the right side.
②A pause period is inserted by once every 6 channels.
③The printing intervals are about 42mm for 6-point input, about 84 mm for 12-point input and about 168mm for 24-point input.

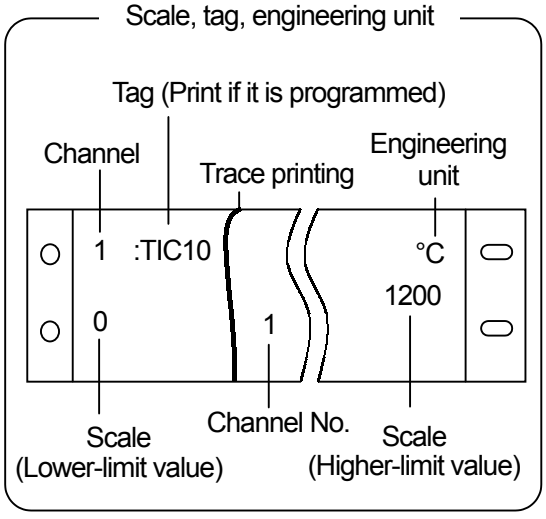


3. Printing intervals of Chart speed

Chart speed is printed in black on the left side of the chart once every twice of channel number printing pause period.

4. Scale, tag, and engineering unit

①These data are printed in the order of channel numbers on the right and left sides of the chart every printing interval of channel number.
② Printing of these data is interlocked with channel numbers, and the scale, tag, and engineering unit of the channel are printed with the same color as in trace printing.
③Tag is not printed, if it is not programmed.



10.2. Restrictions of Printings

1. Stop of digital printing due to chart speed

If the chart speed is programmed to be faster than 251mm/h, none of digital printing is executed, but trace printing only is done. (The time line printing, digital data printing, and list printing can be executed.)

2. Trace printing intervals

The standard intervals are about 5sec/dot, while high-speed trace printing intervals are about 2.5sec/dot. The intervals become longer if the chart speed is reduced for preventing the chart from being damaged due to overlap of dot printing.

<table>
<tr><th>Standard trace printing (about 5 sec./point)</th><th>High-speed trace printing
(about 2.5 sec./point)…..option</th></tr>
<tr><td colspan="2">Printing is restricted by the following formula, if the chart speed is slower than a certain value.
Trace printing intervals (sec./point) $\fallingdotseq \frac{180}{CS \times CH}$
CS : Chart speed CH : No. of channels (excluding skipped channels)</td></tr>
<tr><td><When number of input points is 6 >
<table>
<tr><th>CS (mm/h)</th><th>Intervals</th><th>CS (mm/h)</th><th>Intervals</th></tr>
<tr><td>1</td><td>About 30 sec.</td><td>5</td><td>About 6 sec.</td></tr>
<tr><td>2</td><td>About 15 sec.</td><td>6</td><td rowspan="3">About 5 sec.</td></tr>
<tr><td>3</td><td>About 10 sec.</td><td>7</td></tr>
<tr><td>4</td><td>About 8 sec.</td><td>8</td></tr>
</table>
The interval is kept constant at about 5 sec./print at faster than 6 mm/h.</td><td><When number of input points is 6 >
<table>
<tr><th>CS (mm/h)</th><th>Intervals</th><th>CS (mm/h)</th><th>Intervals</th></tr>
<tr><td>1</td><td>About 30 sec.</td><td>6,7</td><td>About 5 sec.</td></tr>
<tr><td>2</td><td>About 15 sec.</td><td>8,9</td><td>About 4 sec.</td></tr>
<tr><td>3</td><td>About 10 sec.</td><td>10,11</td><td>About 3 sec.</td></tr>
<tr><td>4</td><td>About 8 sec.</td><td>12,13</td><td rowspan="2">About 2.5 sec.</td></tr>
<tr><td>5</td><td>About 6 sec.</td><td>From 14</td></tr>
</table>
The interval is kept constant at about 2.5sec./print at faster than 12mm/h.</td></tr>
</table>

3. Overlapping of digital printings

In case of overlapping of digital printing, the printings are principally executed by the following order of priority.

①Digital data printing/List printing > Time line > Periodic data printing > Alarm printing ≧ Fixed-time printing

②Priority order of fixed-time printing

Time line > Time printing > Channel number = Chart speed = Scale, Engineering unit, Tag

The followings are examples.

Example 1: Digital data printing or list printing is to be executed during another digital printing.

The digital data printing or list printing is executed by interrupting (note) the current digital printing.

Note: The alphabetic and/or numeric characters of the current digital printing are cut off.

Example 2: Time and time line printings are executed during periodic data printing.

The time line only is printed and time is not printed.

Example 3: Fixed-time printing in case of short interval time of periodic data printing.

Under certain conditions, the interval time of fixed-time printing may become longer or the fixed-time printing may not be executed.

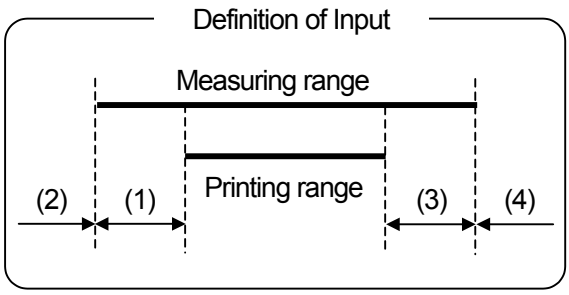
Example 4: Alarm printing is to be executed during fixed-time printing (scale, engineering unit, and tag)

Alarm printing is executed instead of the right side printing of scale or engineering unit printing.

10.3. Operations at Abnormal Inputs

1. Over-range input

The operation differs according to whether the input is out of the printing range being programmed by [range / printing range] or out of the measuring range determined by range number.



Input		Digital display	Printing	
			Digital	Trace
Excessively small input	①Out of the printing range	Normal	Normal	Lower-limit overshooting
	②Out of measuring range *	_ _ _ _ _	_ _ _ _ _	
Excessively large input	③Out of the printing range	Normal	Normal	Higher-limit overshooting
	④Out of measuring range *	_ _ _ _ _	+ _ _ _ _	

*Measured value is obtained in digital display and printing even if the input exceeds the measuring range by about ±10%.

2. Burnout

The burnout function is for overshooting the trace printing to either higher limit or lower limit, if an input is disconnected.

[Whether burnout is enabled or disabled] can be programmed every channel. See par.11.11. In case of a channel where the voltage input range is programmed, the burnout is becomes [disabled] even if it is programmed to be enabled (higher-limit or lower-limit).

Programming burnout	Digital display	Printing	
		Digital	Trace
nonE (Disabled)	Undefined	Undefined	Undefined
doWn bUrn (Lower limit)	bUrn	BURN	Lower-limit overshooting
UP bUrn (Higher limit)	bUrn	BURN	Higher-limit overshooting

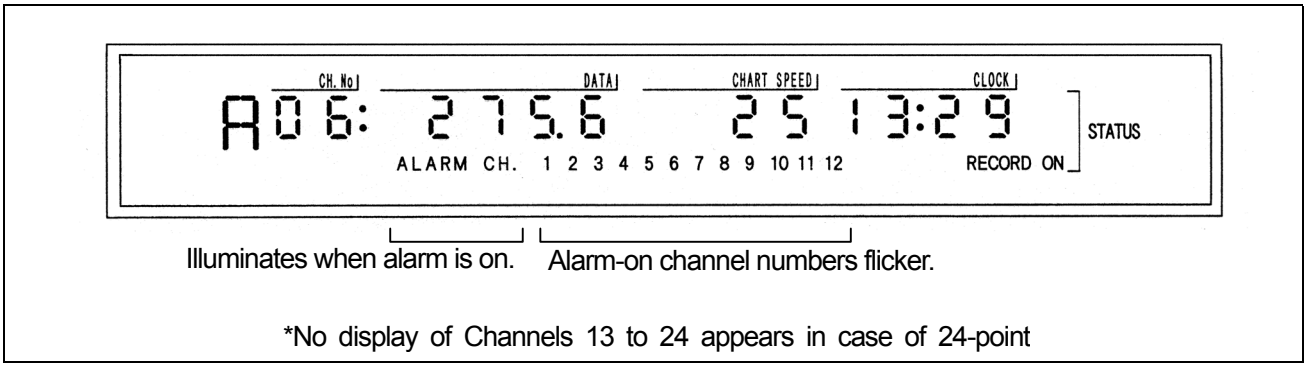
10.4. Display and Printing of Alarm-On

The alarm functions when [alarm] is programmed. (See par. 11.5).
The display for alarm status differs between multi-point sequential display and multi-point simultaneous display.

1. Multi-point sequential display

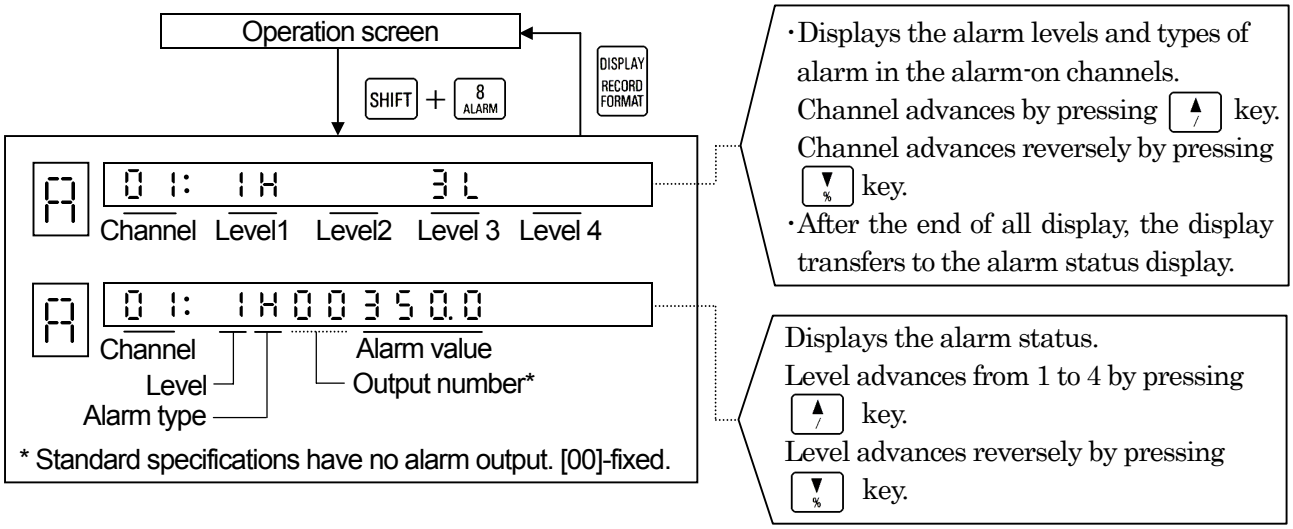
1) Display of alarm-on

①If alarm is on, ALARM CH. (red) of the display illuminates, and alarm-on channel numbers (green) flicker.
②For cancelling the flicking, press ENTRY key.



2) Alarm status check

The alarm channel levels and alarm status can be checked.

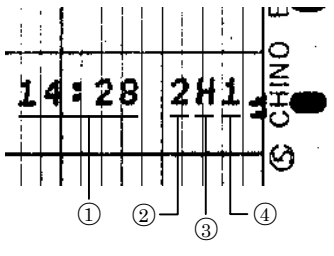


3) Printing of alarm-on / alarm-reset

Alarm-on or alarm-reset is printed on the right side of the chart.

On	①Time ②Channel ③Alarm types ④Level
Reset	①Time ②Channel ③ -(Hyphen) ④Level

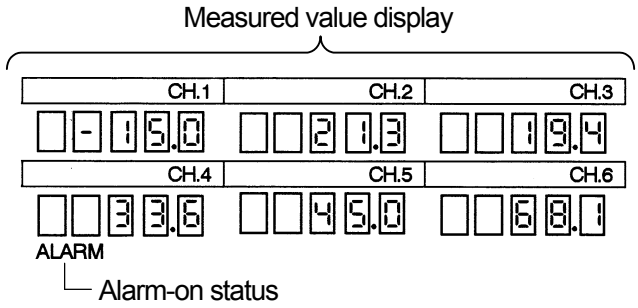
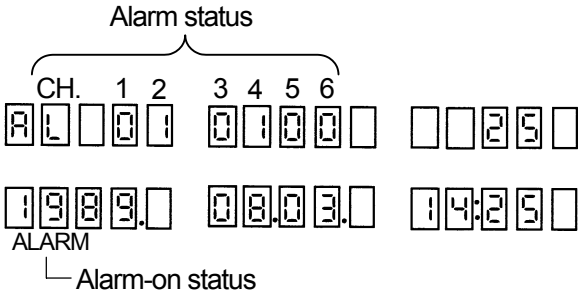
An example of alarm-on printing



2. Multi-point simultaneous display

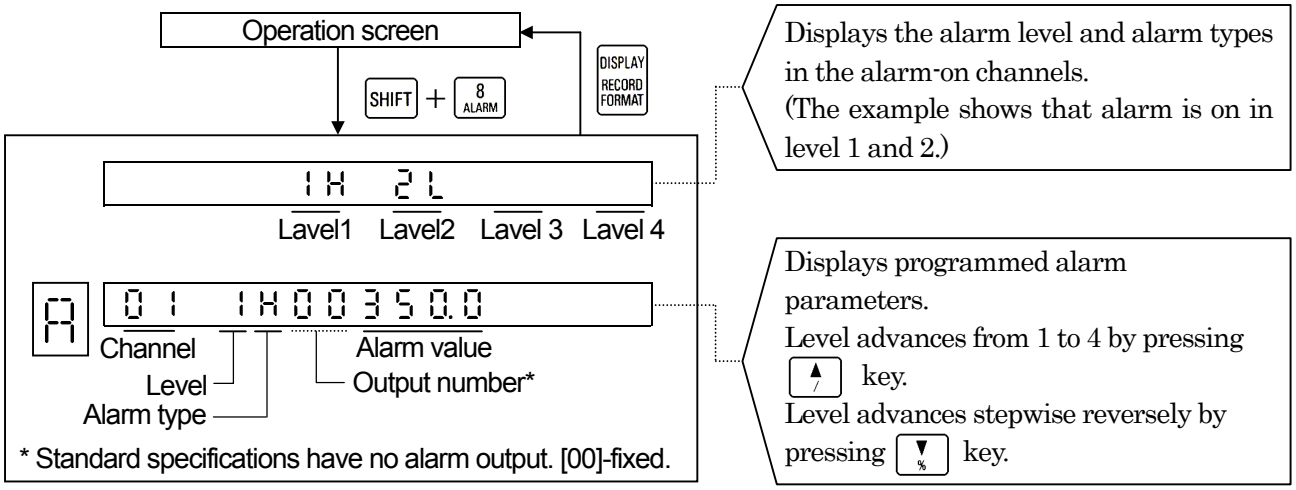
1) Display of alarm-on

The alarm-on status and channels can be known in all operation screens.

Measured value display	Time display
Status : ALARM illuminates. Channel : A measured value in each alarm-on channel flicketrs.  *For cancelling the flickering, press ENTRY key.	Status : ALARM illuminates Channel : Alarm-on channel numbers are displayed.  The above figure shows 6-point input.

2) Alarm status check

The alarm channel level and alarm status can be checked.

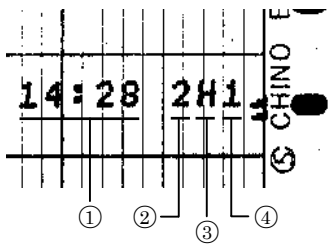


3) Printing of alarm-on / alarm-reset

Alarm-on or alarm-reset is printed on the right side of the chart.

On	①Time ②Channel ③Alarm types ④Level
Reset	①Time ②Channel ③ -(Hyphen) ④Level

An example of alarm-on printing

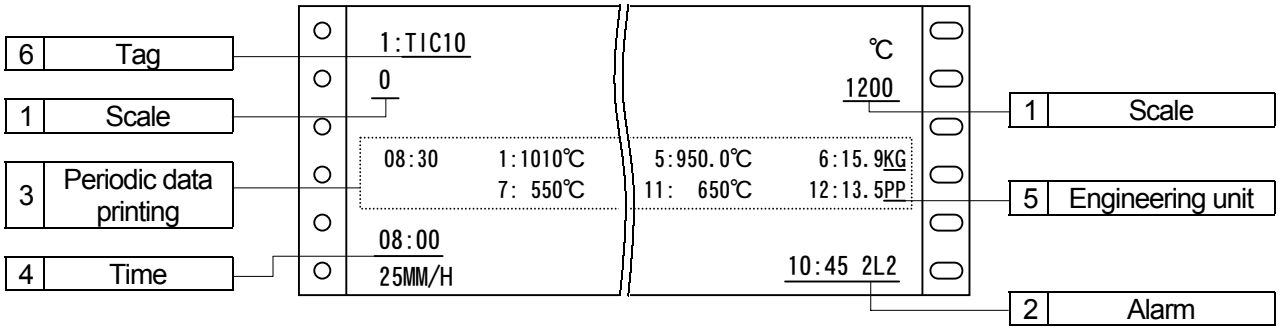


11. OTHER PROGRAMMABLE PARAMETERS/FUNCTIONS

11.1 List of other Programmable Parameters/Functions

1. Various functions

[An example of printings on chart during operation]



7 Burnout enabled/disabled

If a sensor or input wirings are disconnected, data become undefined. When the burnout function is programmed to be enabled, the following display and printing are executed on higher-limit burnout and lower-limit burnout.

Display	bUrn
Printing	B U R N

8 Passcode/key lock

Key lock: Lock or unlock all keys.

Passcode: By programming a passcode (a 4-digit numeric), the key lock selection cannot be executed without entering the passcode.

[Reference] [Keys required for unlock] and [display] key are effective under the key lock condition.

2. Programming parameters and default values

Programming parameters		Transfer to parameters	Programming contents	Defaults	Programming methods
1	Scale	SHIFT + 4 SCALE	Scaling of printing range (Ex. 0 to 14pH)	0.00 to 5.00	Par. 11-2
2	Alarm	SHIFT + 8 ALARM	Channel/level Alarm type/alarm value	Not programmed	Par. 11-5
3	Periodic data printing	SHIFT + 5 DATA I	Data interval time and start time	Not programmed	Par. 11-7
4	Time	SHIFT + . CLOCK	Year/month.day/time	Japanese time	Par. 11-8
5	Engineering unit	SHIFT + 3 UNIT	Max. 5 digits with alphabetic and/or numeric characters every channel	V	Par. 11-9
6	Tag	SHIFT + 2 TAG	Max. 9 digits with alphabetic and/or numeric characters every channel	Not programmed	Par. 11-10
7	Burnout	SHIFT + ▼ % (Longer than 3 sec.)	Burnout enabled or disabled is programmed every channel (higher-limit or lower-limit)	Disabled	Par. 11-11
8	Passcode/ key lock	SHIFT + ▲ / (Longer than 3 sec.)	Passcode: 4-digit numeric for programming	Passcode: Not programmed	Par. 11-12
			Key lock: Locked or unlocked	Key lock: Unlocked	

Note: Channel skip, subtract printing and coping function are also available.

11.2. Scale

[Scale] programming is necessary when a voltage input from a converter, etc. is displayed on an actual scale. However, the scale is programmed with the same characteristic scale (not linearized scale) as voltage input. This programming is also necessary when the decimal point position is changed in thermocouple or resistance thermometer input channels.

By pressing [SHIFT] + [4 SCALE] keys from the operation screen, the scale programming display appears.

1. Programming scale

This is the actual scale (physical quantity) programming to the printing range being programmed in [range/printing range].

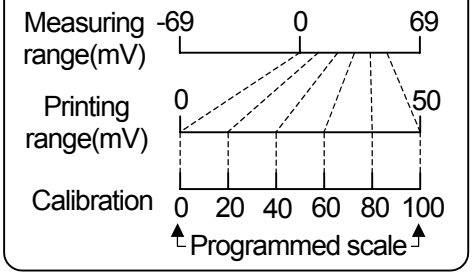
2. Copy of printing range

By programming [range/printing range], the printing range reflects (copies) to the programming value of the scale.

If the scale copied from the printing range is used, the decimal places programmed by the printing range are neglected and the measured values with fixed decimal places by range number are displayed and printed. The following table shows the cautions to be observed according to the input types.

Concept of scale programming

Assume that range No.03 (±69mV) and printing range of 0 to 50(mV) are programmed to 0 to 100(ℓ/min)



In case of voltage ranges	In case of temperature ranges
Scale programming is not required when the scale is equal to the printing range, but be carefull with the decimal places of scale.	Since the printing range is copied to the scale, no programming scale is necessary, but the decimal places of measured value are fixed by range number. For changing the decimal places, refer to 3.

3. An example of decimal point

Voltage range

①When the printing range is equal to the scale;

Range/printing range	Scale programming	An example of measured values	Note
03/0.0 to 50.0	0.0 to 50.0	5.00	1
	0 to 50	5	2
03/0 to 50	0.0 to 50.0	5.0	

Note 1: Decimal places of measured value are fixed by range number when the printing range is equal to the scale.

Note 2: Decimal places of programmed scale become effective because different decimal places are programmed on printing range and scale. See ②.

②When the scale is programmed with the different value from the printing range. The decimal places of programmed scale become effective.

Temperature range

①For increasing the decimal places

Range/printing range	Scale programming	An example of measured values	Note
23/0 to 1200	0.0 to 1200.0	850.0	
23/0.0 to 1200.0	0.0 to 1200.0	850	1

Note 1: Decimal places of measured value are fixed by range number when the printing range is equal to the scale.

②For decreasing the decimal places

Range/printing range	Scale programming	An example of measured values	Note
25/0 to 200	0 to 200	120.0	
	0 to 200.0	120	1

Note 1: Conforms to the decimal places rule.

→ **Remarks 1**

Remarks 1 Decimal places rule

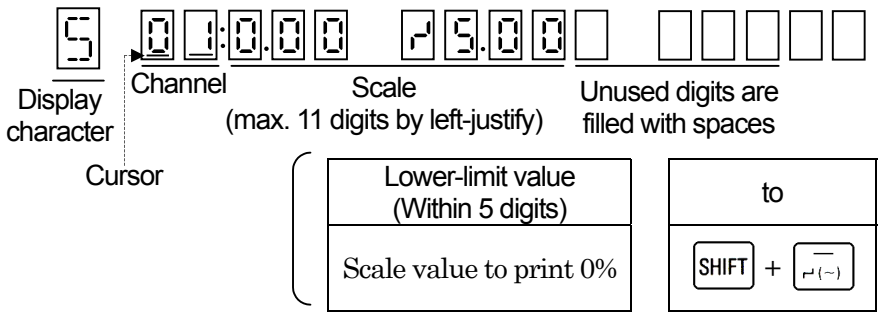
If the decimal places of the lower-limit value and higher-limit value are different, the decimal places, whichever is smaller, is adopted.

(Example)0.00 to 100.0 → 0.0 to 100.0

Reference For programming the same scale to other channels;

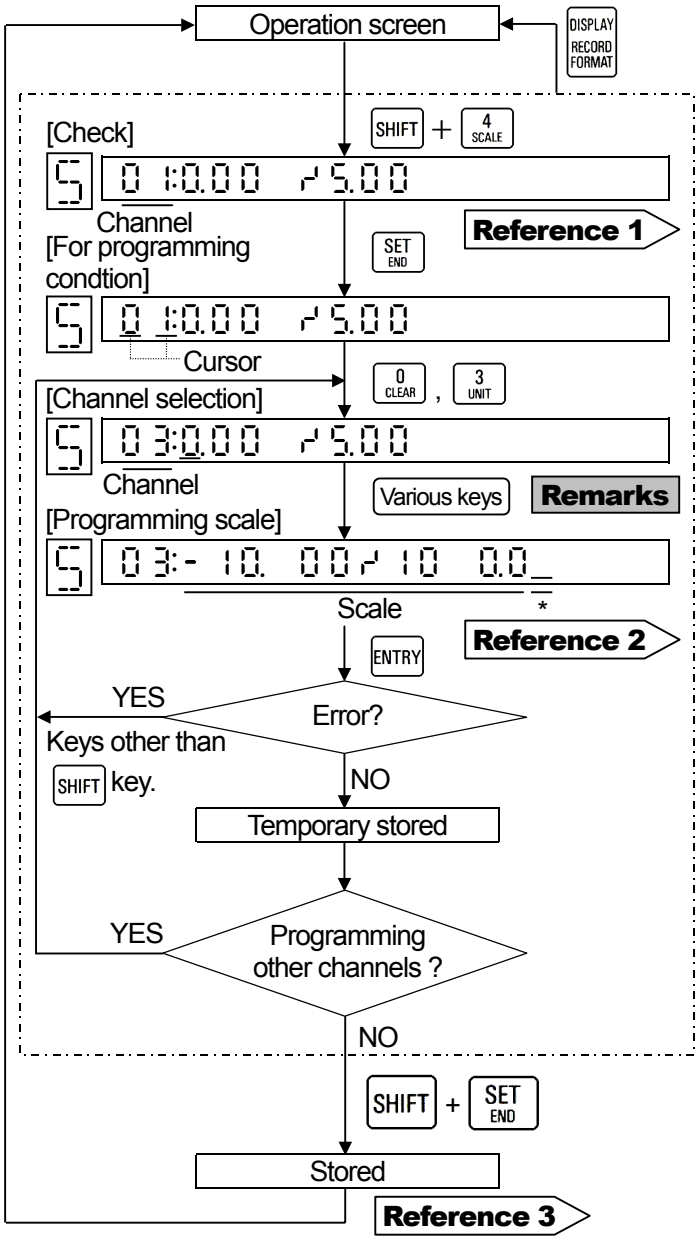
The [Copy] function is convenient. Refer to par. 11.13.

4. Programming display



5. Programming flow chart

<Example> Programming channel 03 to -100 to +100



Remarks For programming the scale to "none"

①Select the channel to be programmed to "none" by ▲/ ▼% keys. *

②Perform [temporary stored] → [stored] after clearing (SHIFT + 0 CLEAR).

*If the channel is programmed by a numeric value, not by Up and Down keys, and cleared, the channel before programming change is programmed to scale "none".

Note) The scale of the channel, of which scale was programmed to "none", reflects the printing range being programmed by [range printing range].

The engineering unit is fixed by range number. Tag and alarms are cleared (not programmed).

Reference 1 Other channels check

Channels are changed by pressing ▲/ or ▼% key.

The programmed scale of other channels can be checked.

Reference 2 Various keys

・Addition/deletion of decimal point…

After moving the cursor rightward.

. CLOCK / SPACE COPY(=) → Numeric keys.

・Programming "to" (-)….. SHIFT + (-)

・Space…….. SPACE COPY(=)

Reference 3 Storing

[Temporarily stored] programmed values are stored into memory. (Programming change mark is printed.)

* Fill surplus digits with a space.

11.3. Skip (Channel Deletion) Function

When clearance (non-programming condition) is stored in range programming, printing and display can be skipped. By pressing [SHIFT] + [7 RANGE] keys in operation screen, the [range/printing range] programming display appears. No skip function is programmed to all channels as the default function.

1. If skipped

Programmed parameters of [scale], [engineering unit], [tag], and [alarms] of the skipped channel are also cleared.
Program the parameters again if necessary when the channels are restored to no-skipped status.

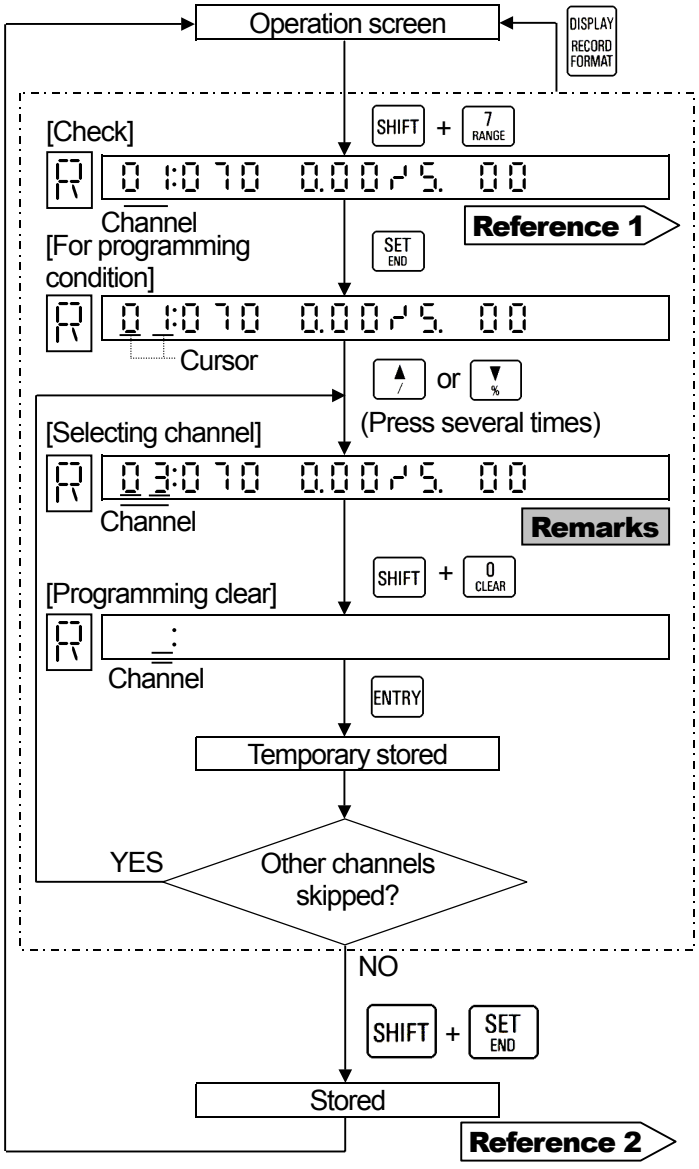
Operation of skipped channels

The instrument functions, assuming that the skipped channels do not exist.

①Measured value display…… Disappear
②Data printing, Trace printing.. Disabled
③Channel display
(multi-point sequential display only)
…….. Disappear

2. Programming skip flow chart

<Example> Skip channel 03.



Remarks Channel selection

Select a channel by [▲ /] or [▼ %] key. When a channel is programmed by a numeric key and cleared the channel ([01] in case of flow chart) being displayed before programming change is deleted.

Reference 1 Other channels check

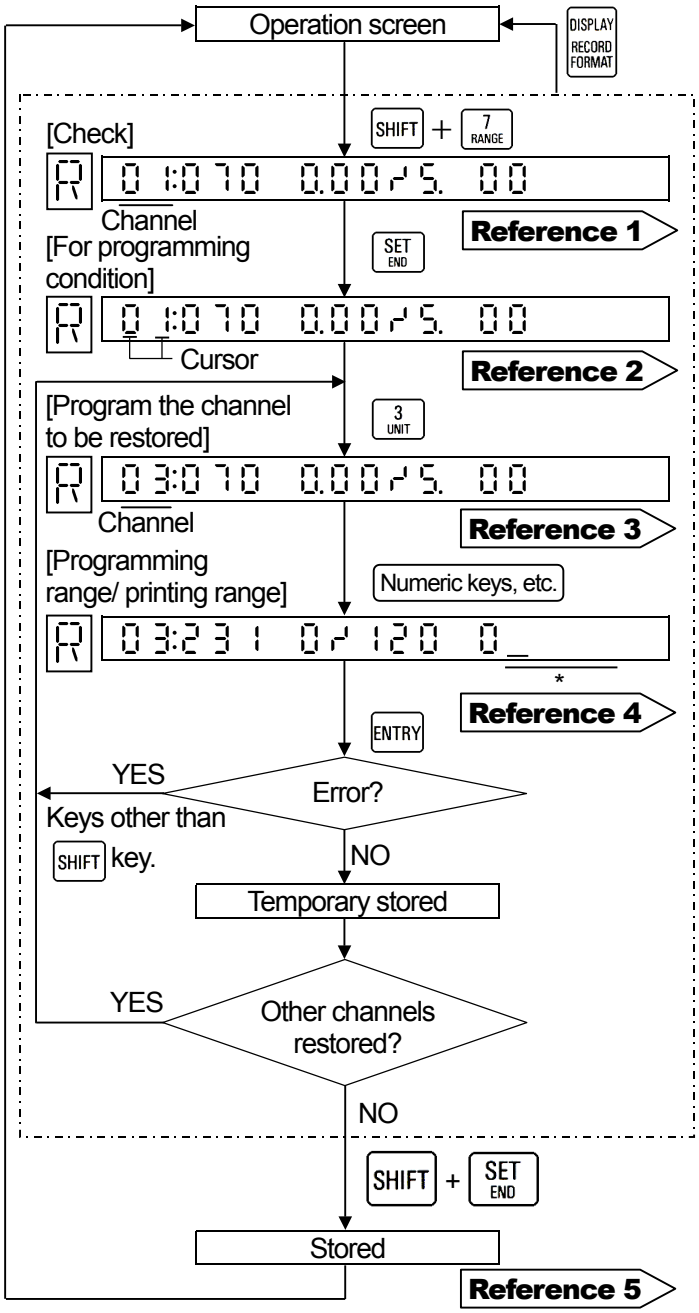
Channels are changed by pressing [▲ /] or [▼ %] key. The programmed range of other channels can be checked, but the skipped channels are jumped.

Reference 2 Storing

[Temporarily stored] programmed condition are stored into memory. (Programming change mark is printed.)

3. Programming flow chart for reprogramming to no-skipped status

<Example> Reprogram channel 03 to no-skipped condition and program the range to K thermocouple 0 to 1200 °C



Other programming parameters

Programmed parameters of [scale], [engineering unit], [tag], and [alarms] are cleared in the skipped channels.

1) Select the operation unit in [°C/°F operation selection], if the desired channels to be restored only are programmed to the temperature range.
2) Program [scale] if necessary in case that the desired channels to be restored is programmed to the voltage range.
3) Program [engineering unit], [tag], and [alarms] if necessary.

Reference 1 Skip channel checking method

Range-programmed channels can be checked by pressing ▲/ or ▼% key. The skipped channels are jumped.

Reference 2 Starting channel

This operation can be started with any channel. In case of the example in the flow chart, channel 01 is the starting channel. The programmed parameters of channel 01 remain unchanged.

Reference 3 Channel No. to be restored

Channel 03 is the object to be restored in the example.

Reference 4 Range/printing range programming method

Refer to par.8.2.

Reference 5 Storing

Store the [temporarily stored] programmed condition into memory. (Programming change mark is printed.)

*Fill surplus digits with a space.

11.4. Subtract Printing Function

This programming is for printing a difference between channels or between a channel and the reference value. By pressing [SHIFT] + [7 RANGE] keys, the [range/printing range] programming display appears and this mode is transferred to the programming [subtract printing].

1. Kinds of subtract printing

① Printing of a difference between reference channel and subtraction channel.
② Printing of a difference between reference channel and a specified subtraction value (reference value). Program one of two printings in the programming procedure.

Remarks 1 Programming reference channel and subtraction channel

[Range/printing range] of both the reference channel and the subtraction channel must have been previously programmed.

Remarks 2 Put a decimal point to the reference value

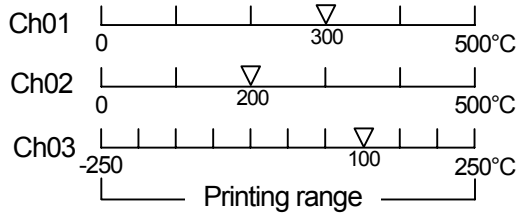
Program the reference value by the value programmed on scale within 5 digits. Be sure to put a decimal point to the reference value having no decimal point.
(Example: 15 → 15.0)

Subtract printing channel

Any channel is selectable for printing a difference. Ch01- Ch02 can be specified to Ch02, for example. In this case, the display and printing of Ch02 become a [difference].

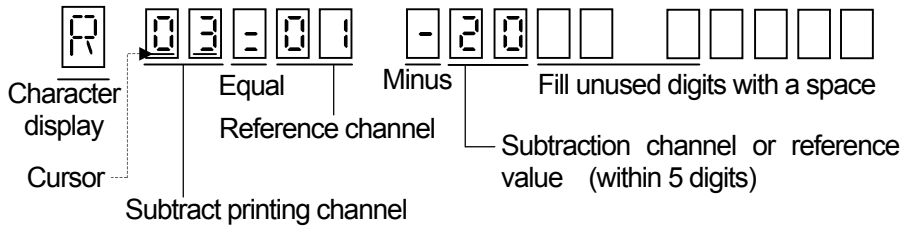
Concept of subtract printing

The following figure shows an example when a difference between Ch01 and Ch02 is printed to Ch03.



2. Programming modes

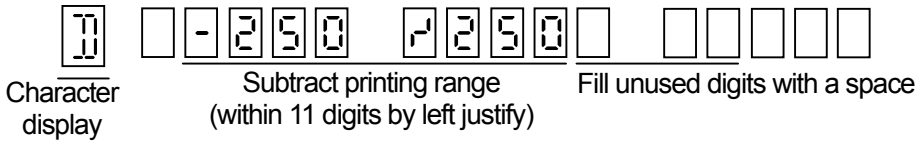
1) Mode1



Character display

R represents subtract printing mode 1

2) Mode 2 (Mode 1 is transferred to mode 2 by pressing [ENTRY] key after the end of mode 1 programming)



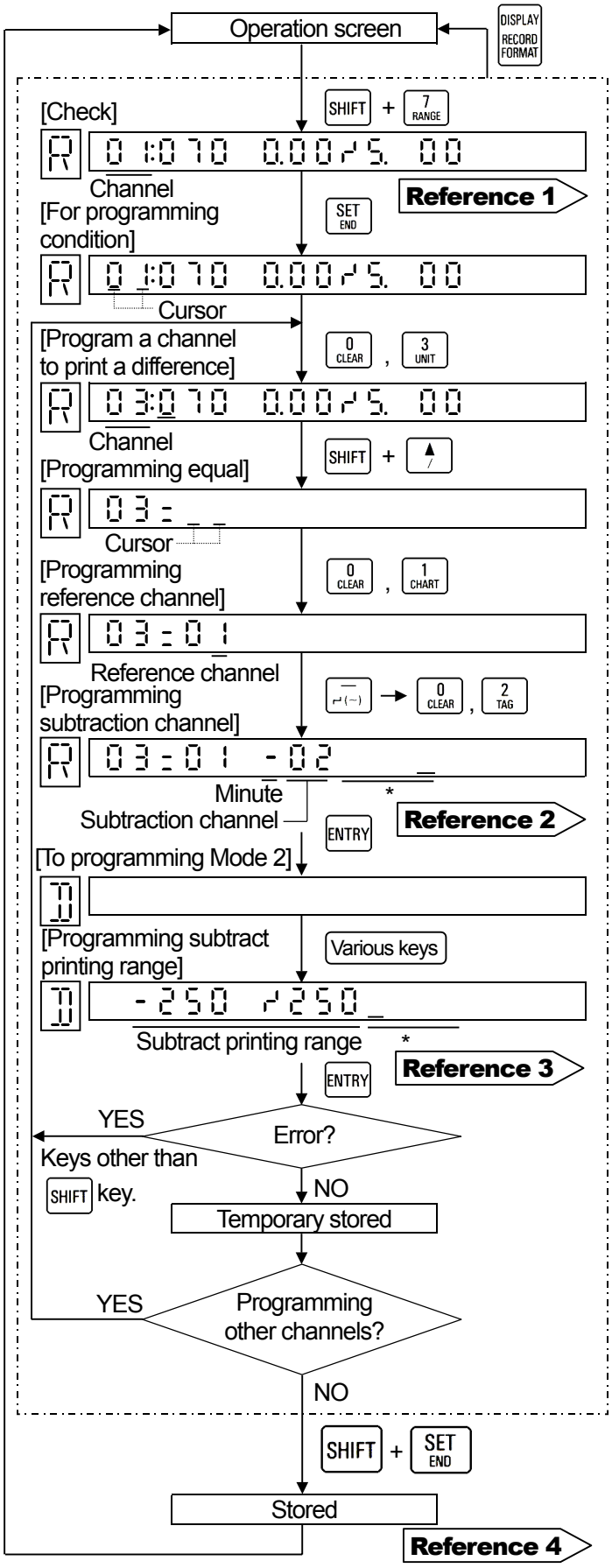
Lower-limit value (within 5 digits)	to	Higher-limit value (within 5 digits)
Input value to print 0%	[SHIFT] + [.(~)]	Input value to print 100%

Character display

D represents subtract printing mode 2.

3. Programming flow chart

<Example> Printing of (channel 01 - channel 02) within a printing range of ±250 in channel 03.
Reference channel / Subtraction channel / Subtract printing channel



Reference 1 Other channels check

Channels are changed by pressing % or / key.
The range programming (including subtract printing) can be checked.

Reference 2 Programming subtraction channel or subtraction reference value

If a specified value (reference value) is programmed instead of the subtraction channel in the flow chart, the subtract printing with the reference value is executed. Add a decimal point to the reference value.

Reference 3 Various keys

"to"(-)..... SHIFT + (-)
Decimal point..... CLOCK in the next digit.

Deletion of decimal point
SPACE COPY(=) in the next digit.

Reference 4 Storing

Store the [temporarily stored] programmed value into memory. (Programming change mark is printed.)

*Space surplus digits.

11.5. Programming Alarms

Alarm parameters (alarm types, alarm value, etc.) can be programmed for each alarm point (channel, level). By programming alarm parameters, display of alarm-on and printings of alarm-on/reset can be executed. The [alarm parameters] programming display appears by pressing [SHIFT] + [8 ALARM] keys.

1. Alarm parameters

The default is "alarms not programmed".

1) Alarm points (channels, levels)
   Alarm points can be programmed maximum 4 levels every channel.

2) Alarm types
   Alarm types can be selected every alarm point out of six kinds shown below.

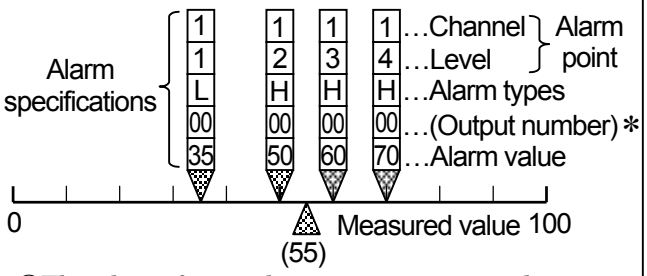
Absolute value	H:Higher-limit alarm	L:Lower-limit alarm
Rate-of-change	U:Increase-limit alarm	d:Decrease-limit alarm
Differential	b:Differential higher-limit alarm	5:Differential lower-limit alarm

3) Alarm value
   A desired alarm generation value.

4) Others
   ・Rate-of-change alarm…..Program measuring count (1 to 9).
   ・Differential alarm……Program channels to be compared.

Relation between alarm parameters and alarm

- In case of absolute value alarm -



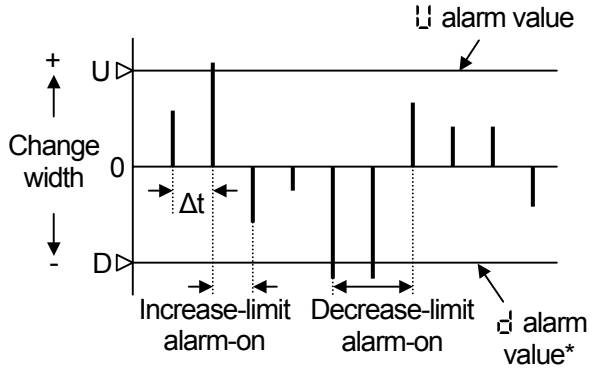
①The above figure shows programming alarm points up to level 4 on channel 1.
②Alarm is on at level 2 (higher limit) as the measured value (55) is higher than alarm value (50).
*Standard specifications have no alarm output. [00]-fixed

2. Alarm types

The higher-limit alarm of an absolute value alerts when alarm value ≦ measured value, while the lower-limit alarm alerts when measured value ≦ alarm value.
For the rate-of-change alarm and differential alarm operations, refer to the following figure.

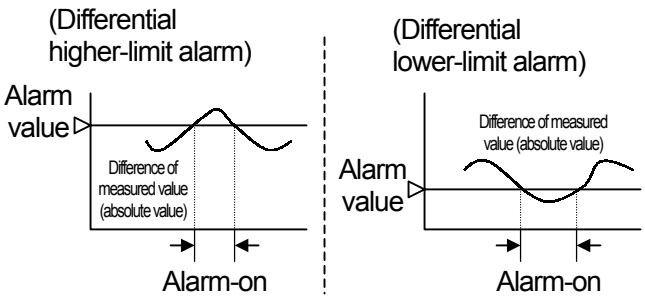
Rate-of-change alarm

Increase-limit alarm: Change width (PV2-PV1) per unit time (Δt) is plus.
Decrease-limit alarm: Change with (PV2-PV1) per unit time (Δt) is minus.



Unit time(Δt) =
Measuring interval × measuring count (1 to 9)
*Minus symbol is not attached to the alarm value of decrease-limit alarm(d).

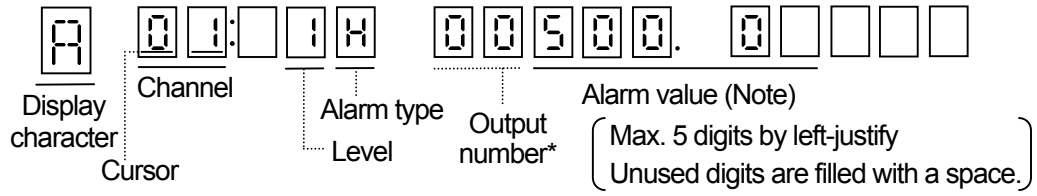
Differential alarm



Differential higher-limit alarm alerts when difference (absolute value) of measured values ≧ alarm value
Differential lower-limit alarm alerts when difference (absolute value) of measured values ≦ alarm value

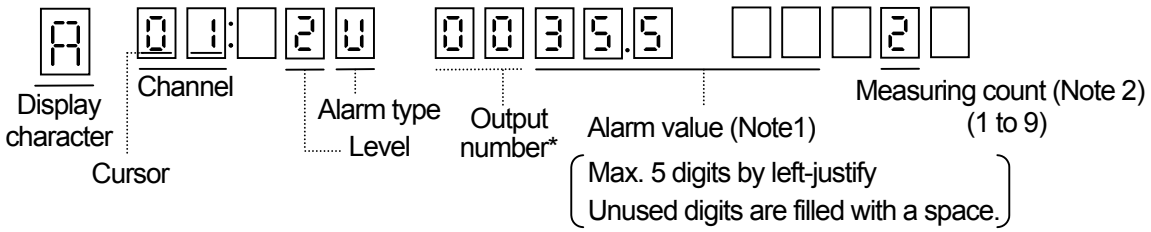
3. Programming mode

1) Absolute value alarms (H.L) ;



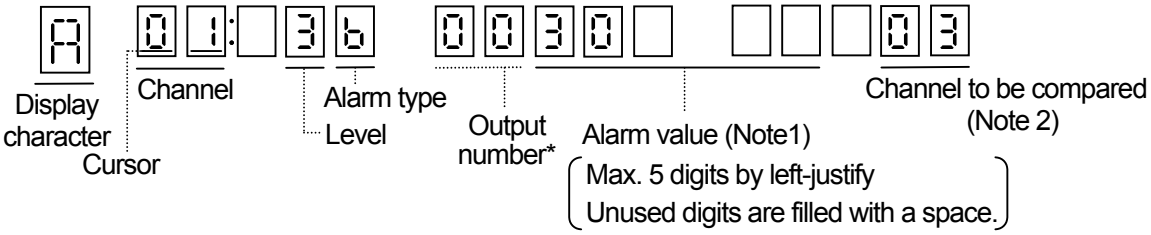
(Note) Program alarm values within the scale range.

2) Rate-of-change alarm(U.d) ;



(Note 1) Program alarm values with a change width (without sign) per unit time.
(Note 2) Unit time = Measuring interval (about 5sec.) × measuring count.
Program this measuring count (1 to 9).

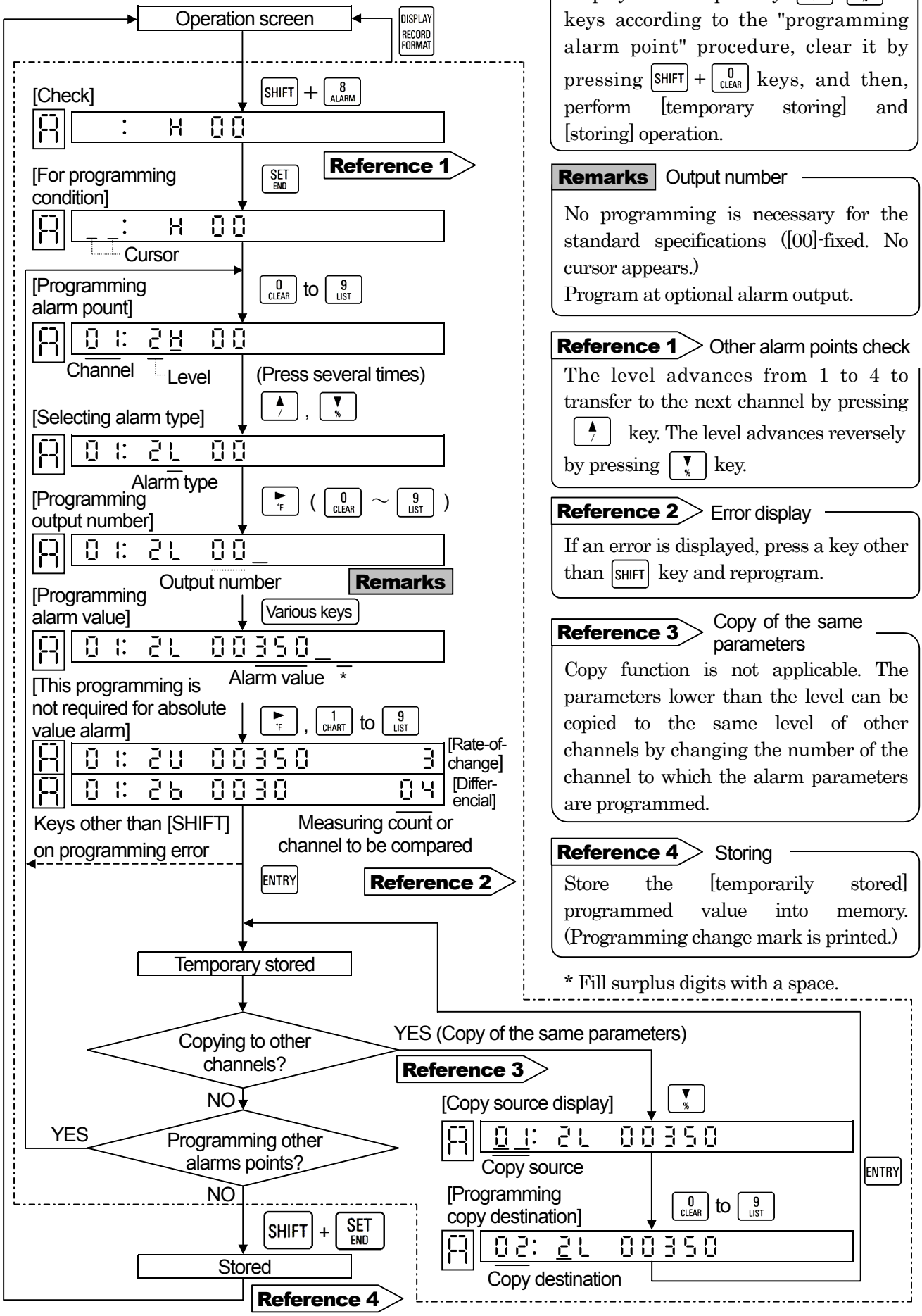
3) Differential alarm (b.S) ;



(Note 1) Program alarm values with a difference (without sign) of measured values between channels.
(Note 2) Program another channel to be compared.

*As standard specifications are [00]-fixed, no cursor appears.
Program at optional alarm output only. ⟶ refer to par 12.1.

4. Programming flow chart



Deleting an alarm point

Display an alarm point by ▲/ ▼% keys according to the "programming alarm point" procedure, clear it by pressing SHIFT + 0 CLEAR keys, and then, perform [temporary storing] and [storing] operation.

Remarks Output number

No programming is necessary for the standard specifications ([00]-fixed. No cursor appears.)
Program at optional alarm output.

Reference 1 Other alarm points check

The level advances from 1 to 4 to transfer to the next channel by pressing ▲/ key. The level advances reversely by pressing ▼% key.

Reference 2 Error display

If an error is displayed, press a key other than SHIFT key and reprogram.

Reference 3 Copy of the same parameters

Copy function is not applicable. The parameters lower than the level can be copied to the same level of other channels by changing the number of the channel to which the alarm parameters are programmed.

Reference 4 Storing

Store the [temporarily stored] programmed value into memory. (Programming change mark is printed.)

* Fill surplus digits with a space.

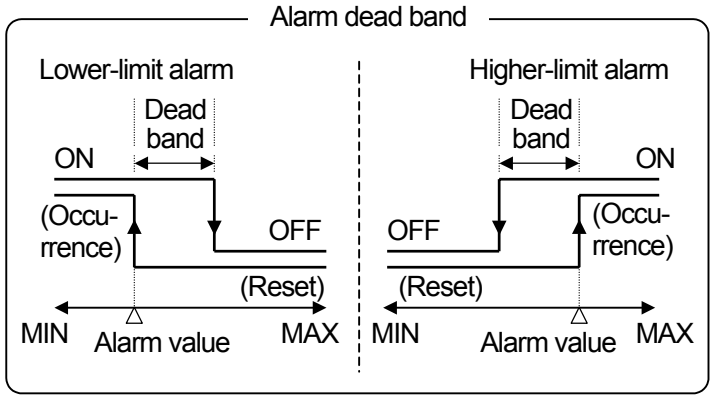
11.6. Programming Alarm Dead Band

Dead band can be programmed between alarm-on and alarm-reset.

By pressing [SHIFT] + [◄ ℃] keys for longer than 3 seconds, the [alarm dead band] programming display appears. This programming is common to all alarm points.

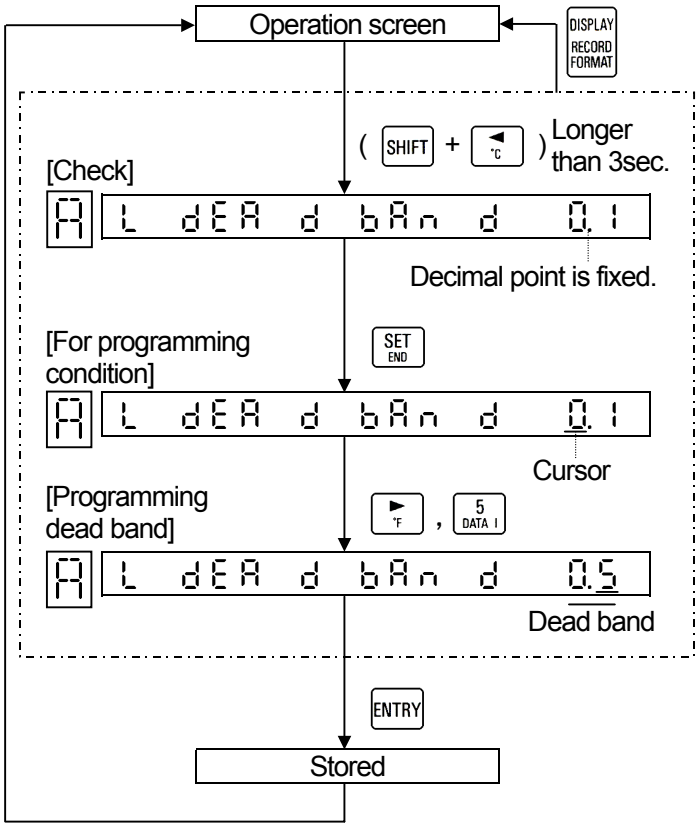
1. Alarm dead band

- An alarm alerts if a measured value exceeds the alarm value. The alarm-reset is executed at the lower point than the alarm value (higher-limit alarm) or at the higher point than the alarm value (lower-limit alarm). This difference is called dead band and represented by % of the scale width.
- Its programming range is 0.1 to 9.9% every 0.1% step.
  The default parameter is 0.1 %.



2. Programming flow chart

<Example> Change from 0.1% to 0.5%.



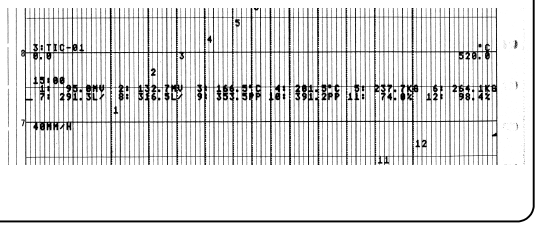
11.7. Periodic Data Printing Function

This programming is for digital printing (data printing) at fixed intervals.
Printing overlaps with trace printing (dot-printing). By pressing [SHIFT] + [5 DATA I] keys, the [periodic data printing] programming display appears. Since the default parameter of periodic data printing is "not programmed" the periodic data printing is not executed.

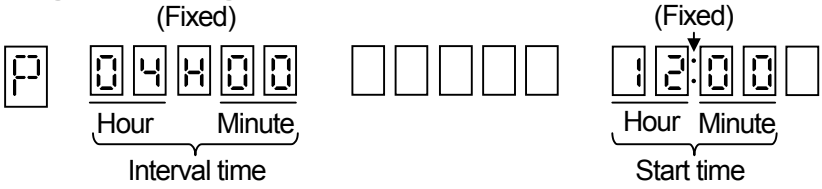
1. Periodic data printing

①Program the start time and interval time.
②The printing format is as shown in the right figure.
<Example> 18 : 30 1 : 225°C 2 : 373°C
Time / Data / Channel / Engineering unit (higher significant 2 digits)

An example of periodic data printing

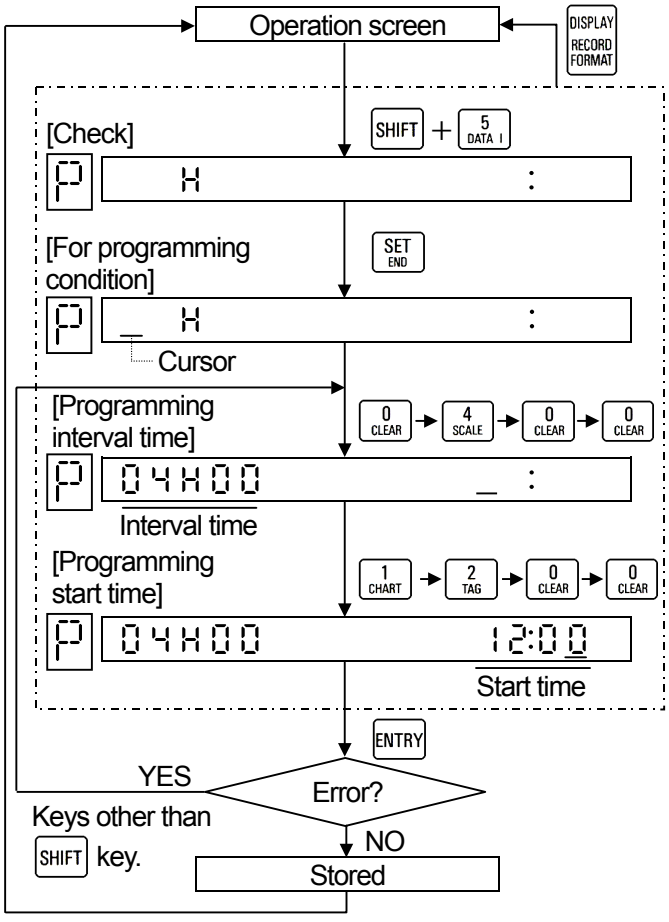


2. Programming mode



3. Programming flow chart

<Example> Programming to start at 12:00 hours and print at 4-hours intervals



Remarks 1 Shortest time of interval time T

This is determined by chart speed and number of printing lines.

$$T(\text{min}) \geqq \frac{180 \times \text{number of printing lines *2}}{\text{Chart speed *1}}$$

*1: The latest speed out of 3 speeds in case of remote contacts signal (option).
*2: The number of printing channels (Note) –
1 to 3 channels: 1 line,
4 to 6 channels: 2 lines
(Note) The number of printing channels differs by the number of skipped channels. However, T is 5 minutes or more.

Remarks 2 For programming periodic data printing to be "none"

Store after clearing ([SHIFT] + [0 CLEAR]).

Remarks 3 When the chart speed is changed;

The programmed values in [periodic data printing] are cleared and the periodic data printing is not executed. Reprogram it if necessary.

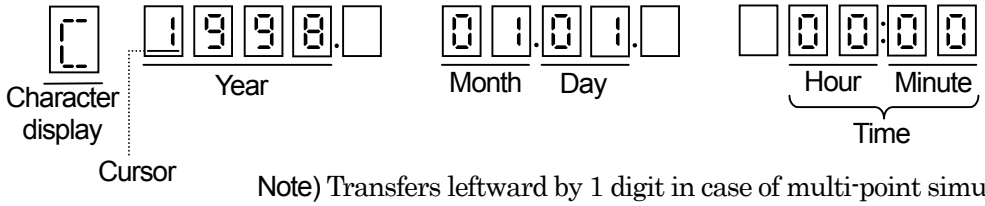
Remarks 4 When turning on the power supply after it has been turned off (due to service power interruption, etc.);

When power supply was turned on (recovered) next day or later and 24/T is not an integer, reprogramming is necessary. (T: Interval time)

11.8. Time

Year, month, day, and time can be programmed. By pressing [SHIFT] + [CLOCK] keys, the [time] programming display appears. The default time is Japanese time.

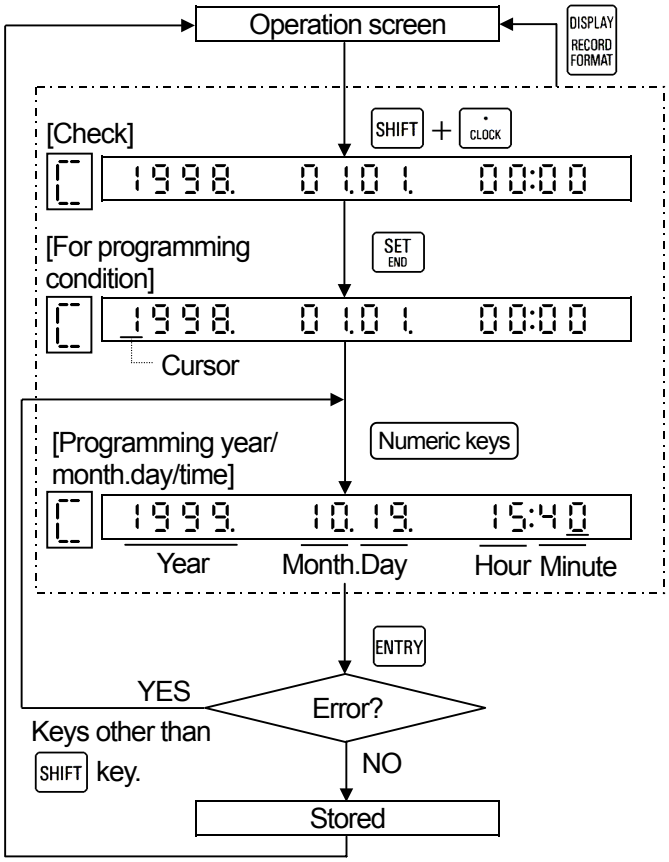
1. Programming mode



Note) Transfers leftward by 1 digit in case of multi-point simultaneous display.

2. Programming flow chart

<Example> From 00:00 hours on January 1, 1998 to 15:40 hours on October 19, 1999



Clock circuit

Clock circuit is sustained for minimum 10 years (8 hours operation/day) by a lithium battery.

Reference 1 Time display during programming

The display of time (hour, minute) remains stopped during programming. It starts when pressing [ENTRY] key.

Reference 2 Programming time

The programming range is 00:00 to 23:59.

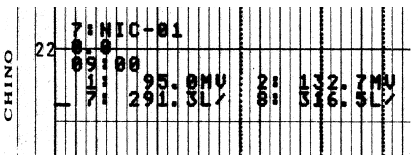
11.9. Engineering Units

An engineering unit of max. 5 digits can be assigned for digital printing, scale printing, and list printing.

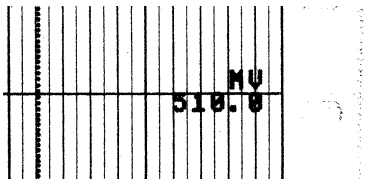
By pressing [SHIFT] + [3 UNIT] keys, the [engineering unit] programming display appears.

An example of unit printing

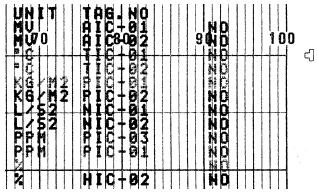
(Digital data printing)



(Scale printing)



(List printing)



1. When no engineering unit is programmed;

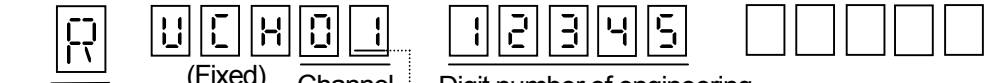
An engineering unit is decided by range number in [range/printing range] programming.

Voltage range		Temperature range	
mV (01 to 05)	V (06 to 10)	°C (Other than the numbers shown right)	K (47,80)

Limitation of digits of an engineering unit

Max. 5 digits can be programmed.
Higher significant 2 digits only are printed in digital printing.

2. Programming mode



Engineering unit character *1

(Fixed)

Channel

Cursor

Digit number of engineering unit character *2 (max. 5 digits)

*1: Engineering unit character
The character at the digit where the digit number is pointed by the cursor is displayed.

*2: Digit number of engineering unit character
A digit number (1 to 5) is displayed by pressing [▶ °F] key for a non-programmed channel.
<For decreasing the number of digits>
After clearing by pressing [SHIFT] + [0 CLEAR] keys, reprogram digit numbers by pressing [▶ °F] key.

By changing range number

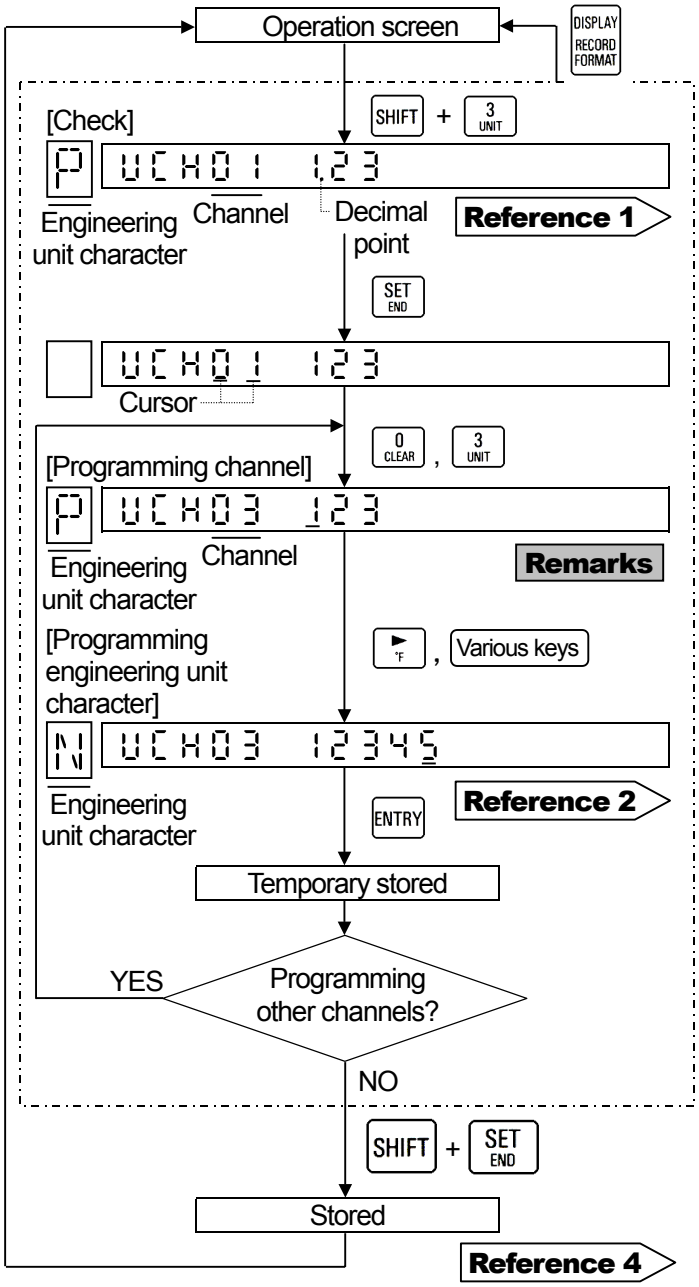
A programmed engineering unit is deleted and the engineering unit determined by the range number is displayed.

If clear is stored by scale

In the channel which has been cleared by scale programming, the programmed engineering unit is deleted and the engineering unit being decided by the range number is displayed.

3. Programming flow chart

<Example> Programming the engineering unit of channel 03 from PPM to G/MIN



(Note)Special characters display

・Multi-point sequential display……..

Special character part at the lower left

・Muli-point simultaneous display……..

Programming character part

Remarks For programming the engineering unit to be "none"

①Select the channel where the engineering unit is set to be "none" by ▲ / or ▼ % key. *

②After clearing(SHIFT + 0 CLEAR),execute [temporary storing] - [storing].

*If the channel is programmed by a numeric value, not by Up and Down keys, and cleared, the channel before programming change is programmed to no engineering unit.

Reference 1 For checking all programmed digits

・Channels are changed by pressing ▲ / or ▼ % key.

・The digit displaying engineering character (digit number having a decimal point) is shifted by ► °F or ◄ °C key.

Reference 2 Programmable characters and key operation

・Numeric values (0 to 9, -):

0 CLEAR to 9 LIST , (-)

・Alphabetic characters (A to Z):

Select a character by pressing ▲ / or ▼ % after pressing SHIFT + 6 A~Z

・Special characters (%,/,°C,°F) (Note)

%(SHIFT + ▼ %), /(SHIFT + ▲ /)

°C(SHIFT + ◄ °C)*, °F(SHIFT + ► °F)*

*A space corresponding to 2 digits is used.

・ SPACE COPY(=) (Space)…..A space is a character.

Reference 3 °C, °F engineering unit programming

These engineering units are treated as a printing unit only. They are not treated as operation engineering units.

Reference 4 Storing

Store the [temporarily stored] programmed value into memory. (Programming change mark is printed.)

11.10 Tags

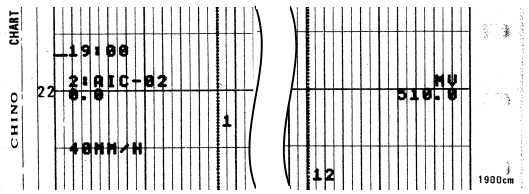
A tag (TAG) of max. 9 digits can be assigned for channel printings (scale, list).

The [TAG] programming display appears by pressing [SHIFT] + [2 TAG] keys.

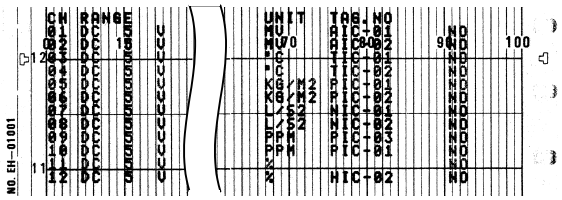
As the default parameter is "not programmed", no character appears.

Tag printing example

(Scale printing)

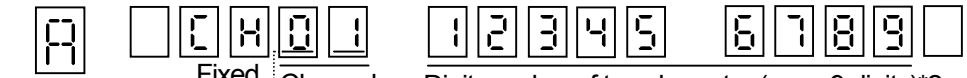


(List printing)



1. Programming mode

Note) The default parameter of tag is "not programmed". The following figure shows 9-digit programming.



Tag character *1

Fixed

Channel

Cursor

Digit number of tag character (max. 9 digits)*2

*1: Tag character

The character at the digit where the digit number is pointed by the cursor is displayed.

*2: Digit number of tag character

A digit number (1 to 9) is displayed by pressing [°F] key for a non-programmed channel.

<For decreasing the number of digits>

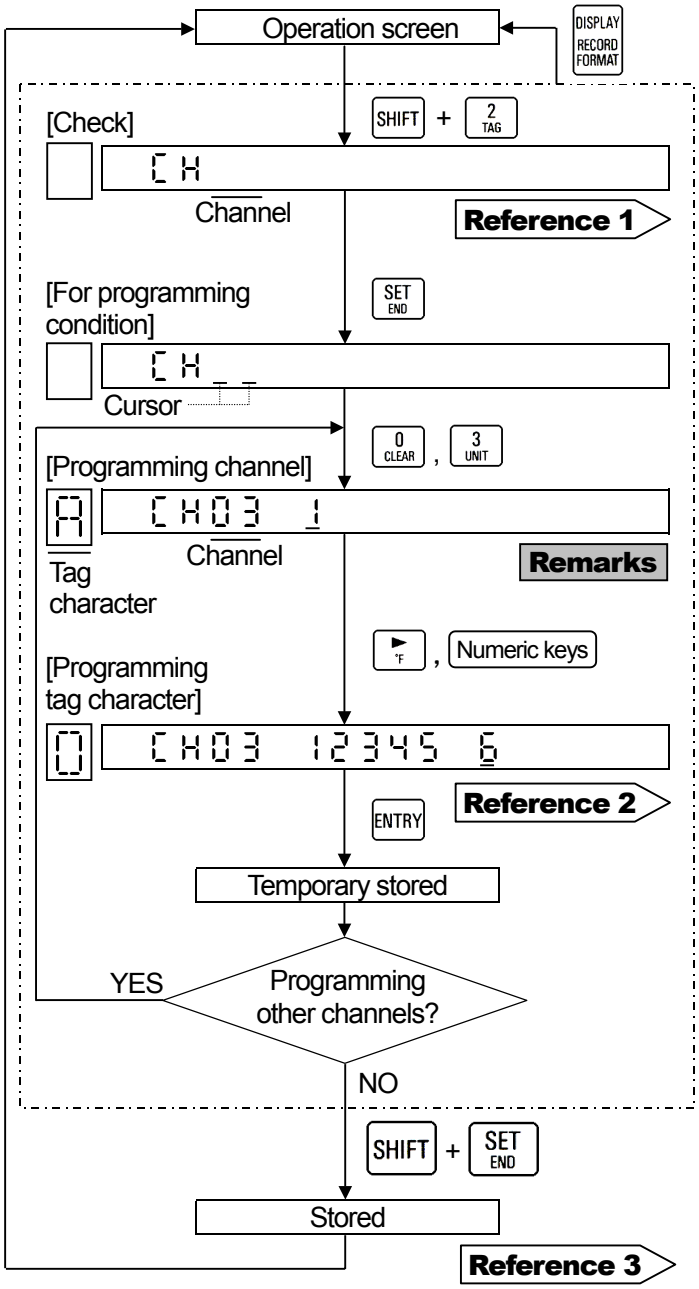
After clearing by pressing [SHIFT] + [0 CLEAR] keys, reprogram the digit numbers by pressing [°F] key.

If clear is stored on scale

In the channel which has been cleared on scale programming, the programmed tag is deleted. Reprogram it if necessary.

2. Programming flow chart

<Example> No tag to TIC- 10 in channel 03



(Note) Special characters display

・Multi-point sequential display……..

Special character part at the lower left

・Multi-point simultaneous display……..

Programming character part

Remarks For programming the tag printing to be "none"

①Select the channel where the tag is programmed to be "none" by ▲/ or ▼/% key. *

②After clearing(SHIFT + 0 CLEAR),execute [temporary storing] ⟶ [storing].

*If the channel is programmed by a numeric value, not by Up and Down keys, and cleared, the channel before programming change is programmed to no-tag.

Reference 1 For checking all programmed digits

The tag character appears at the programmed channels (where digit number is displayed) only.

・Channels are changed by pressing ▲/ or ▼/% key.

・The digit displaying tag character (digit number having a decimal point) is shifted by ►°F or ◄°C key.

Reference 2 Programmable characters and key operation

・Numeric values (0 to 9, -):

0 CLEAR to 9 LIST , —/↵(−)

・Alphabetic characters (A to Z):

Select a character by pressing ▲/ or ▼/% after pressing SHIFT + 6 A~Z

・Special characters (%,/,°C,°F) (Note)

%(SHIFT + ▼/%), /(SHIFT + ▲/)

°C(SHIFT + ◄°C)*, °F(SHIFT + ►°F)*

*A space corresponding to 2 digits is used.

・ SPACE COPY(=) (Space)…..A space is a character.

Reference 3 Storing

Store the [temporarily stored] programmed value into memory. (Programming change mark is printed.)

11.11. Burnout Function

The channel where the temperature range has been programmed becomes effective.

By pressing [SHIFT] + [▼%] keys for longer than 3 seconds in operation for each screen, the [burnout enabled/disabled] programming display appears. Perform this programming for each channel.

1. Burnout

- If a sensor (thermocouple or resistance thermometer) is disconnected, trace printing overshoots the higher-limit or lower-limit.
- The default parameter of burnout is "disabled" (Non) in all channels.

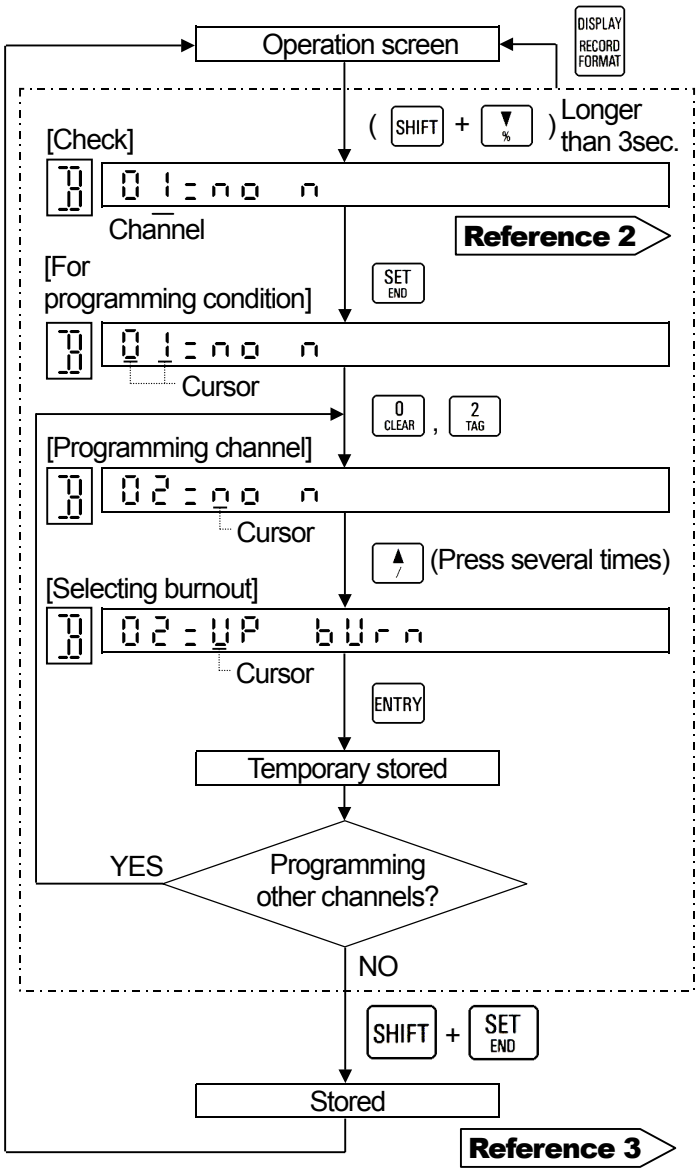
Burnout selection menu

Burnout can be selected for each channel out of 3 kinds shown below.

nonE (Non)	: Burnout disabled
UP bUrn (UP burn)	: Up scale burnout
doWn bUrn (down burn)	: Down scale burnout

2. Programming flow chart

<Example>Programming channel 02 from burnout disabled to higher-limit burnout



Remarks 1 nonE programming on parallel operation

A parallel connection of a thermocouple with other instruments causes a trouble. Select (nonE) if this instrument uses the thermocouple being connected with other instruments.

Remarks 2 Voltage range is ineffective

Even if the burnout is programmed to a channel where the voltage range (No. 01 to 07) is programmed, this programming becomes ineffective (burnout disabled).

Reference 1 Burnout operation

For the burnout operation (display and printing), refer to par. 10.3. (on page 10-3)

Reference 2 Other channels check

Channels are changed by pressing [▲/] or [▼%] key. The burnout programming can be checked.

Reference 3 Storing

Store the [temporarily stored] programmed value into memory. (Programming change mark is printed.)

11.12. Passcode/Key Lock

[Key lock] selection procedure differs according to [passcode programmed or not programmed].
By pressing [SHIFT] + [▲/7] keys for longer than 3 seconds in the operation screen, [passcode programmed/ not programmed] check display appears. If the passcode has been programmed, [key lock] selection display will not be accessible without the correct passcode.

1. Passcode

- [Key lock] selection will not be accessible without the correct passcode.
- Since the default parameters is "passcode not programmed", the [key lock] operation can be executed.

Passcode programming range

Program a passcode by a 4-digit numeric value.
Programming range: 0001 to 9999
If 0000 is programmed, a programming error occurs.

Remarks Passcode

Keep your passcode not to be lost.

2. Key lock

If [key lock] is programmed to be effective (LOCKED), no key for the following functions is accepted.

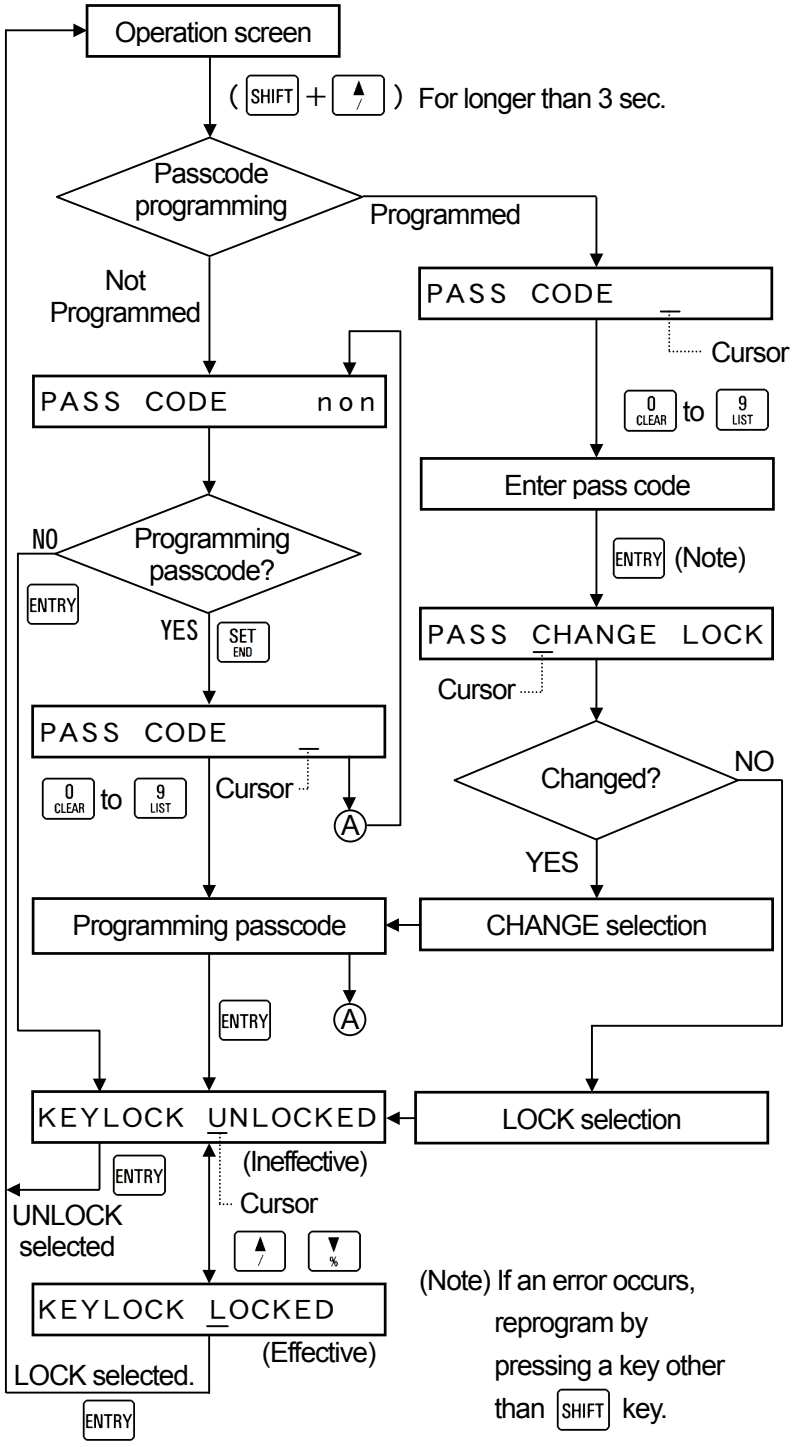
①Programming change of various parameters
②Change of operation (printing on/off, fast chart feeding, digital data printing, and list printing)
However, the following functions are only available.
①Various programmed parameters check.
②Procedure to program the key lock to be ineffective (UNLOCKED).
③Selection of operation screen

Reference Key lock display

KEY LOCK illuminates as the status in the display board when the key lock is LOCKED (effective).

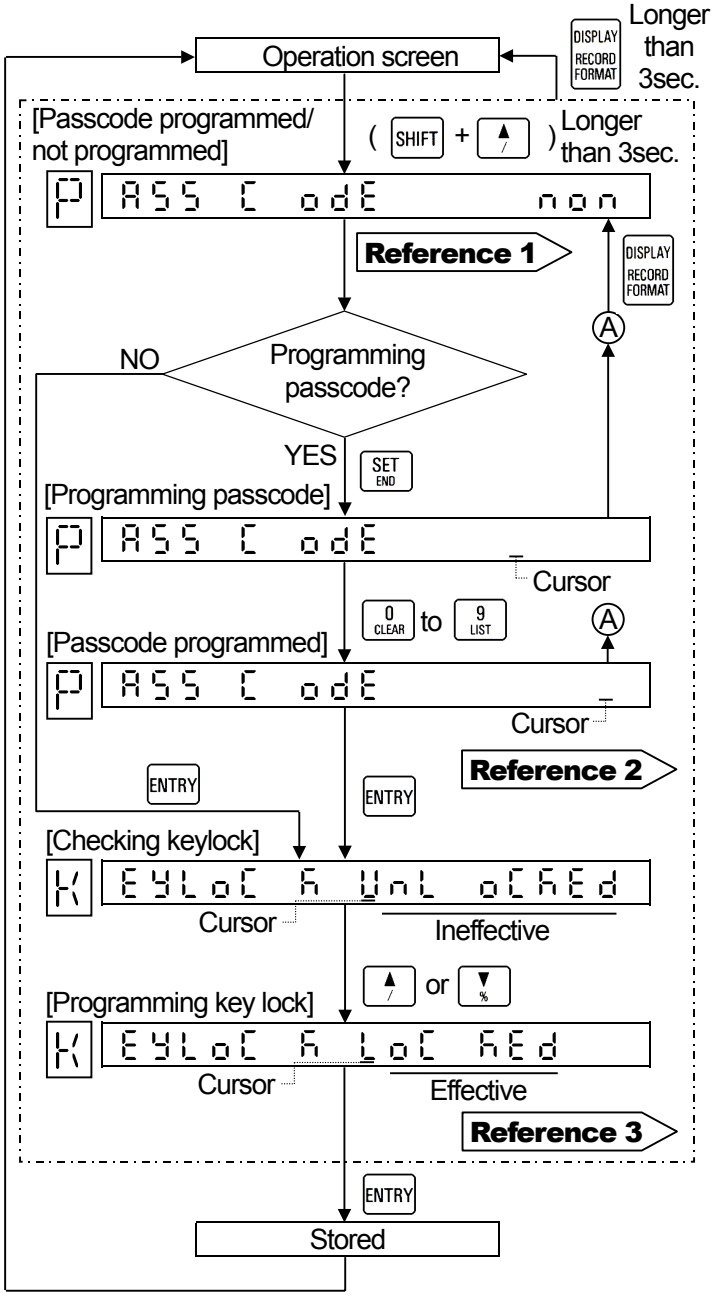
3. Programming flow chart (outline)

The flow differs according to a passcode programmed or not programmed. For details, see the next pages.



4. When passcode is not programmed;

(Example) Program the passcode and program the key lock to be effective.



Reference 1 Passcode programmed/ not programmed

non: Indicates that no passcode is programmed.

— : Indicates that passcode is programmed.

Reference 2 On passcode programmed

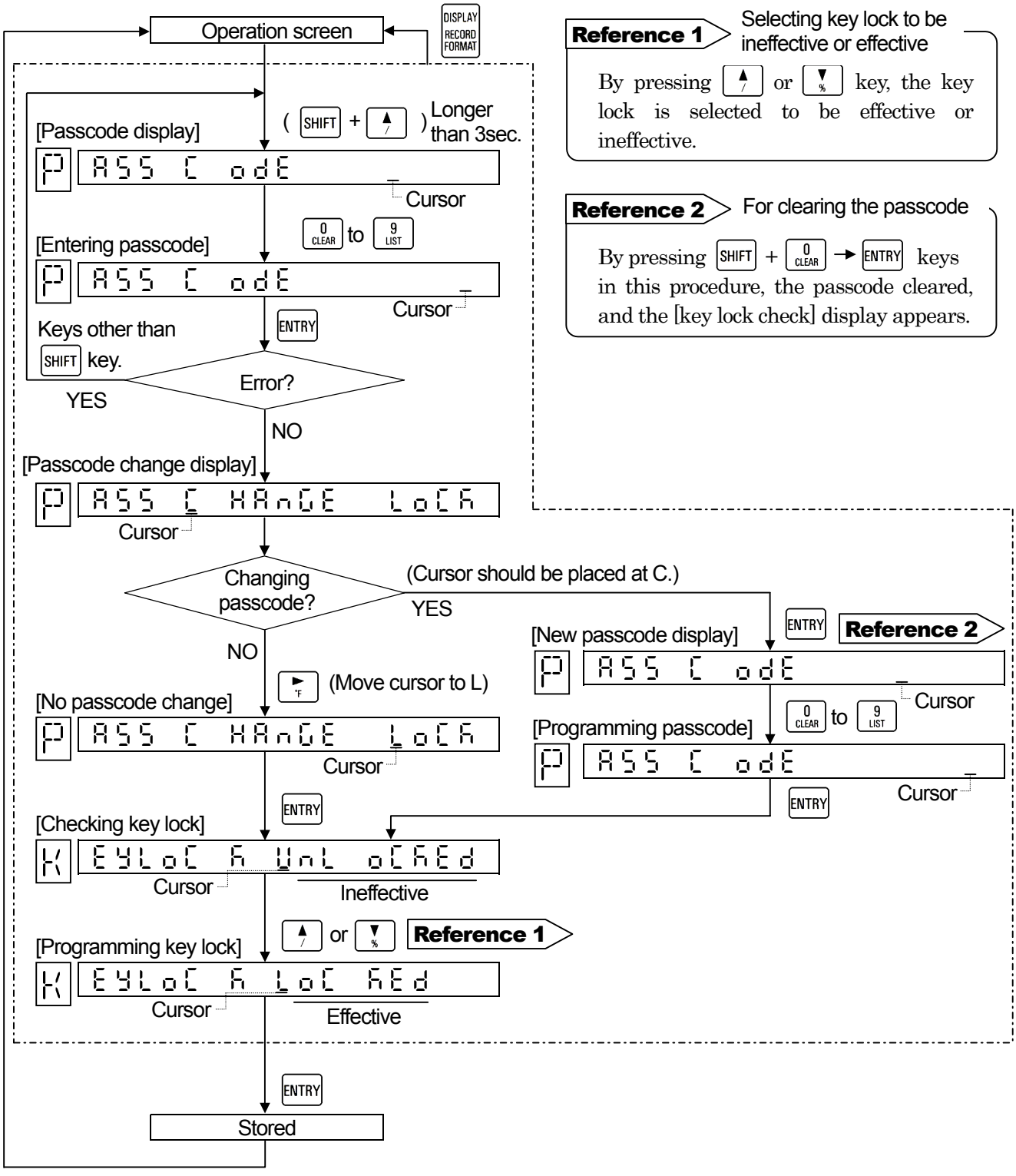
If a passcode is programmed, the [key lock] selection will not be accessible without the correct passcode.
The flow chart shown in 5. is for the procedure of [key lock] selection after a passcode has been programmed.

Reference 3 Selecting key lock to be ineffective or effective

By pressing ▲ / or ▼ % key, the key lock is selected to be effective or ineffective.

5. When the passcode is programmed;

<Example> Program the key lock to be effective when the passcode is changed or not changed.

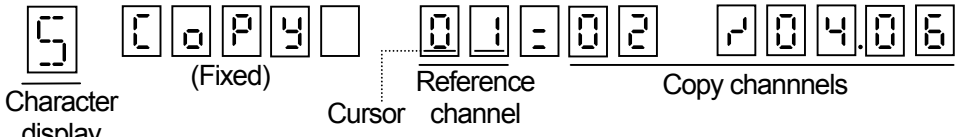


11.13. Copying Function

For the [range /printing range], [scale], [engineering unit], and [tag] to be programmed for each channel, programmed values of an optional reference channel can be copied to other channels.

1. Programming mode.....

An example of programming the [range/printing range] is shown below.



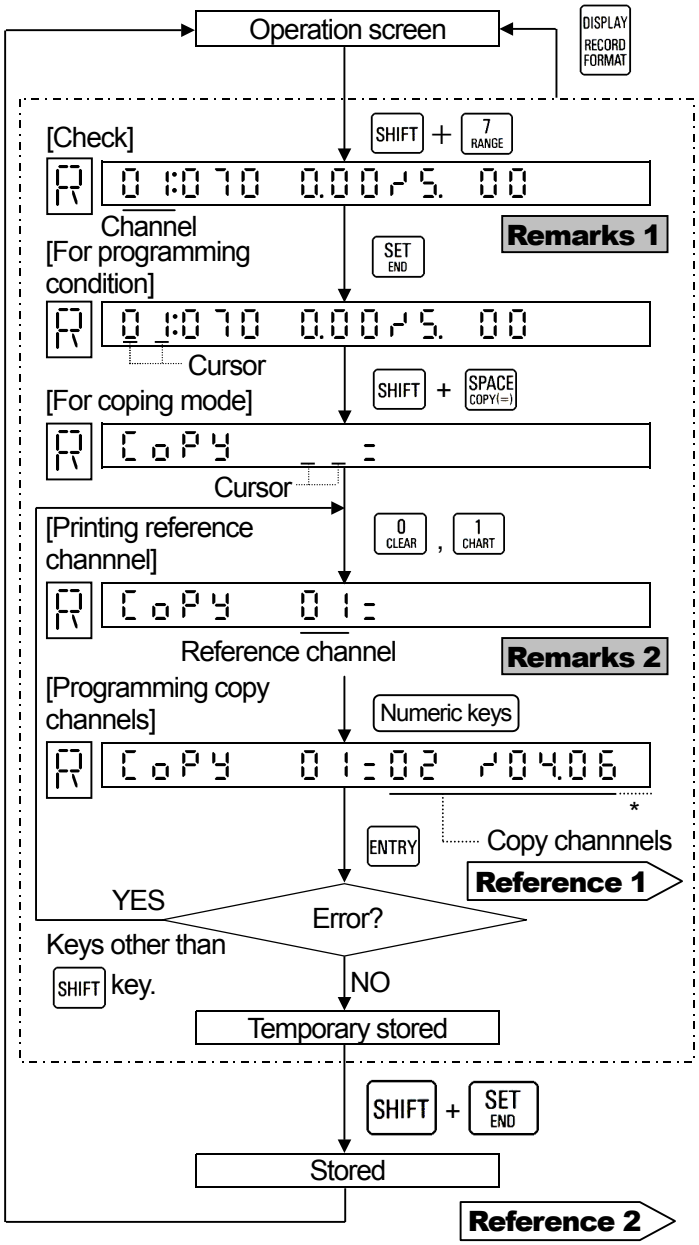
r: Continuous channels
●: Discontinued channels
Surplus digits are filled with a space

Character display

*R: Range/printing range
S: Scale
U: Engineering unit
T: Tag

2. Programming flow chart

<Example> Programming the programmed values of [range/printing range] of channel 01 to channels 02 to 04, and 06.



Remarks 1 Checking skipped channels

Check whether skipped channels are existed or not by pressing ▲/ or ▼/% key.

Remarks 2 Program reference channel to other channels than skipped channels

When a skipped channel is programmed as a reference channel, a [SET ERROR] appears on temporary storing (pressing ENTRY key).

Reference 1 Various keys

"to"(r)..... SHIFT + −/r(−)

Decimal point..... ·/CLOCK at the right digit.

Deletion of decimal point.....

SPACE COPY(=) at the right digit.

Reference 2 Storing

Store the [temporarily stored] programmed value into memory. (Programming change mark is printed.)

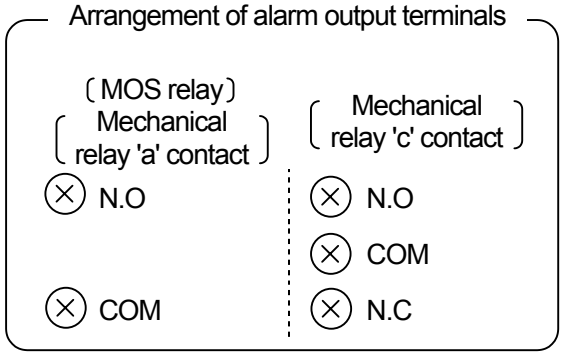
*Fill surplus digits, if any, with a space.

12. ALARM OUTPUT

Alarm output is an option. Program [output number] on every alarm point in the [programming alarm output number] of [alarms] programming.

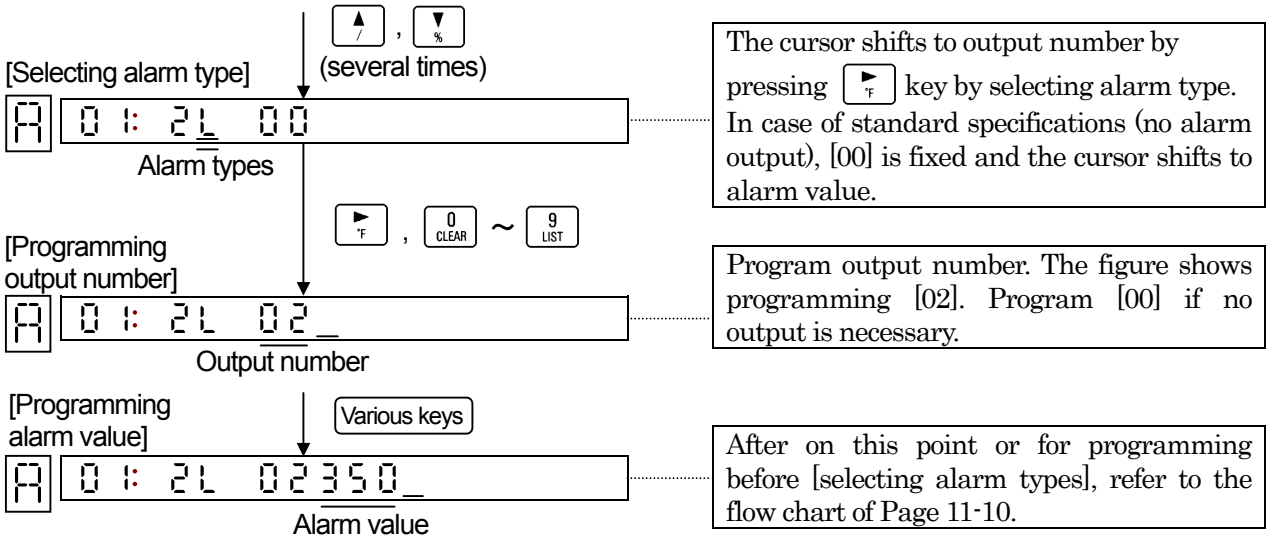
1. Alarm output

When alarm is on, the terminals of N.O and COM of alarm output terminals (output number) specified are shorted as an alarm output. The instrument delivered is with the alarm output (MOS relay, mechanical relay 'a' contact or mechanical relay 'c' contact*) specified.
*Not conforming to international safety standards.



2. Programming alarm

For programming [alarms], refer to par. 11.5 (Page 11.8) and for programming [alarm output], refer to the programming flow chart (Page 11.10). The default is [00] - no output. By pressing [°F] key after [programming alarm types], the cursor shifts to output number for programming output number.



Reference 1 Number of alarm point and number of output point

All alarm points are number of channels × number of levels (4).
As the alarm output points are 6, 12 or 24 points and all alarm points can not be allocated 1:1. Use output number commonly (OR output).

Reference 2 OR output

Multiple alarm outputs can be allocated to one alarm output number. If alarm is on at any alarm point, alarm is outputted at the output number.

Reference 3 Connection of alarm output terminals

Refer to par. 4.5.

Reference 4 Check of alarm output terminals

Refer to par. 17.4.

13. REMOTE CONTACTS

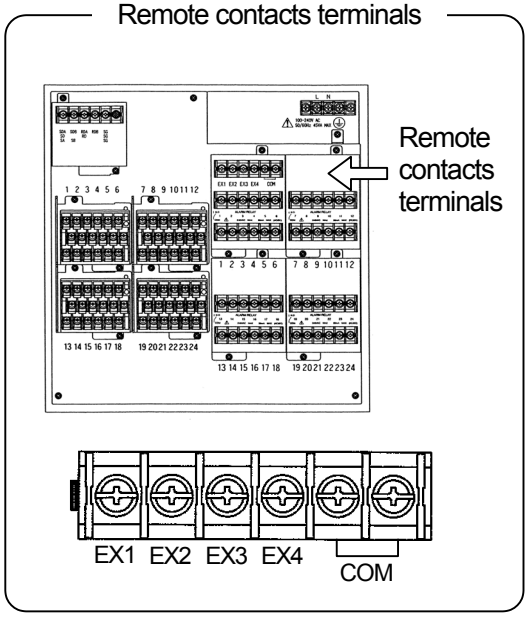
13.1. Remote Contacts Functions ⚠

This function applies to the instrument with a remote contacts function (option) only.

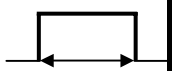
1. Remote contacts

The following operation can be done with contact signals of remote contacts terminals.

1) Printing ON/OFF
   Printing can be turned ON and OFF without [RECORD ON/OFF] → [ENTRY] key.
2) Selection of 3 chart speeds
   Three kinds of chart speeds (CS1 to 3) can be selected (Note).
   (Note) Program CS1 to CS3 in advance.
3) Digital data printing execution
   Data can be printed without key operation.
4) List printing execution
   List printing can be executed without key operation.



2. Terminal contact signals and functions

Functions				Conditions to COM: COM and EX1	COM and EX2	COM and EX3	COM and EX4	Remarks
Printing on-off	ON	Chart speed	CS1	Open	Open	Note 1	Note 2	[RECORD ON/OFF] and [FEED] keys are effective.
			CS2	Short-circuit	Open			
			0S3	Open	Short-circuit			
	OFF			Short-circuit	Short-circuit	Open or short	Open or short	[RECORD ON/OFF] and [FEED] keys are ineffective.
Digital data printing execution (Note 3)				Printing ON condition		Open	Short-circuit	Short for about 1 sec. 
List printing execution						Short-circuit	Open	

Note 1: Digital data printing is executed when terminals are shorted.
Note 2: List printing is executed when terminals are shorted.
Note 3: Short-circuit signal can be accepted once only even during execution.

⚠ Warning No-voltage contact

For the contact to be connected to the remote contacts terminals, use a switch or relay driven at lower than 30VAC or lower than 60VDC or a manual contact for a very small load.

Remarks 1 Printing on-off

Program "printing on/off" to on with a key operation in advance.

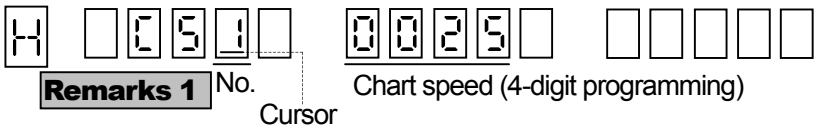
Remarks 2 Relation between chart speed and periodic data printing

The shortest interval time of periodic data printing is limited by the chart speed. See par.11.7.
This applies to the slowest speed out of 3 chart speeds.

13.2. Programming 3 Chart Speeds

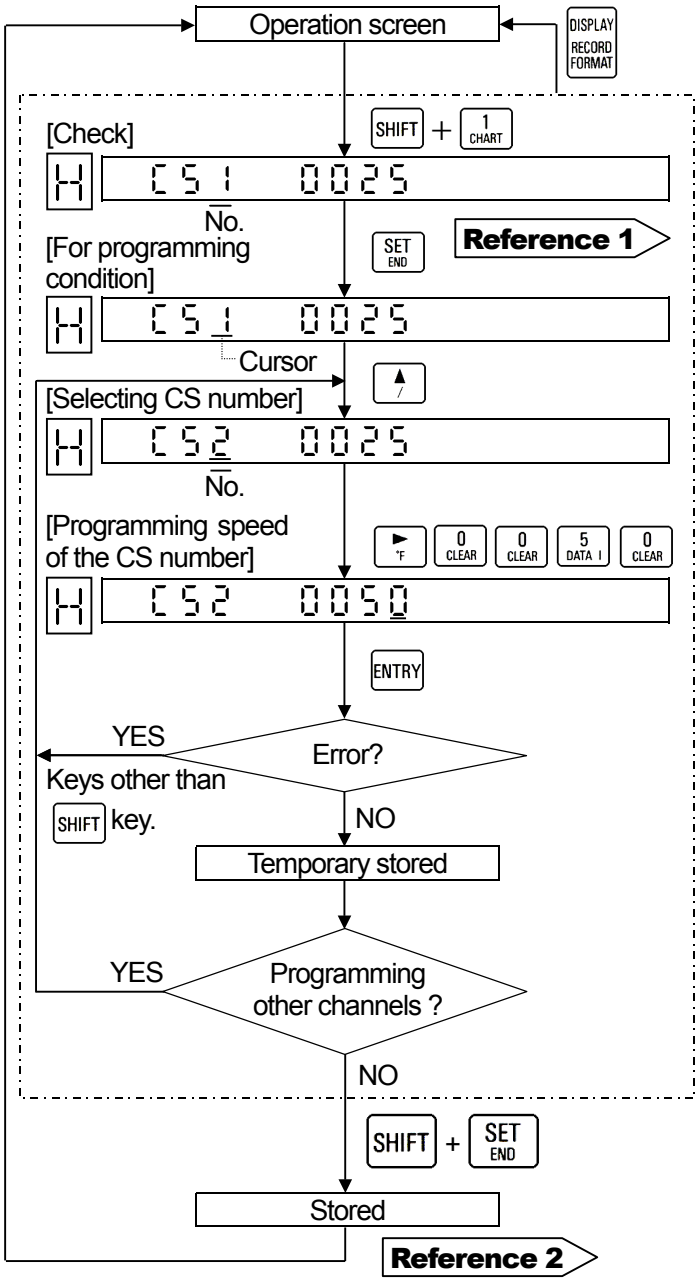
3 chart speeds programming display appears at optional remote contacts only. By pressing SHIFT + 1 CHART keys, the [3 chart speeds] programming display appears. After programming 3 kinds of speed (CS1 to 3), select them with a contact signal.

1. Programming mode



2. Programming flow chart

<Example> Programming CS2 to 50 (mm/h)



Default parameters and programming range

Default : CS1 to 3, 25(mm/h)
Programming range
: 0001 to 1500(mm/h)

Remarks 1 When no number appears;

Remote contacts is not provided. Standard [chart speed] programming is done [Par. 10.2].

Remarks 2

If the Chart speed is programmed to be faster than 251 (mm/h), all printings printing are not executed, but trace printing only is done.

Remarks 3 Influence to periodic data printing

If the chart speed is changed, the programmed parameter in [periodic data printing] (par. 11-7) is cleared.
The lowest value out of 3 chart speeds is applied to the equation for obtaining the chart speed interval time.

Reference 1 Other speed check

CS numbers change to be able to check the chart speed ▲ or ▼ key is pressed.

Reference 2 Storing

Store the [temporarily stored] programmed value into memory. (Programming change mark is printed.)

14. PRINTING FORMAT

14.1. Programming Automatic Range-Shift Printing

Programming display appears at optional printing format only. This programming is to change trace printing range automatically.

1. Automatic range-shift

The automatic range-shift function changes the trace printing range to maximum 5 stages according to the measured values.

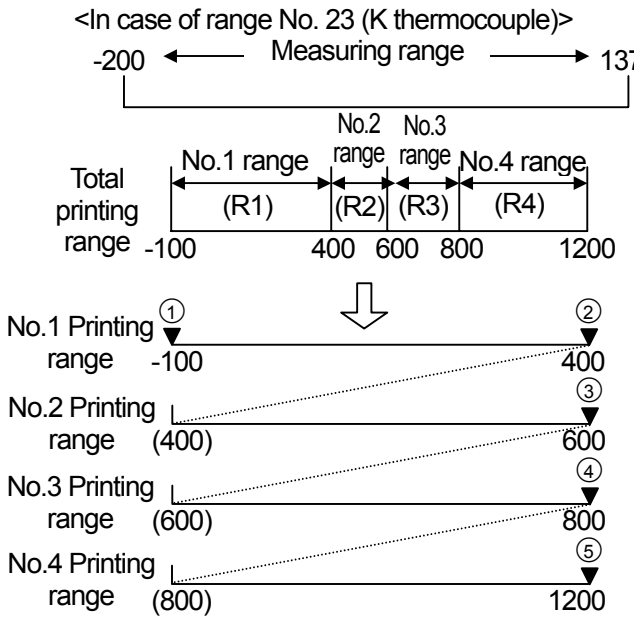
① This programming can be done every channel.

② Total printing range can be programmed optionally, irrespective of the programmed range of the [range/printing range].

③ For each range, refer to the minimum printing range in par. 20.1 (Input Specifications). Dot-printing is dispersed if each range is programmed to be less than the minimum printing range.

④ The ranges are shifted when a measured value exceeds about 0.8mm than the lowerlimit (zero) or higher-limit (span) of each range.

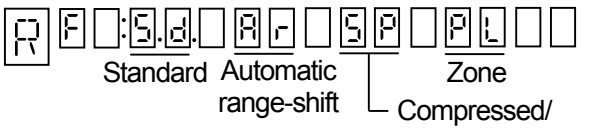
A programming example of automatic range-shift



Mark ▼ shows the programming point and ① to ⑤ show the programming sequence. Press [Entry] key each time programming ends and the operation is transferred to the next programming display.

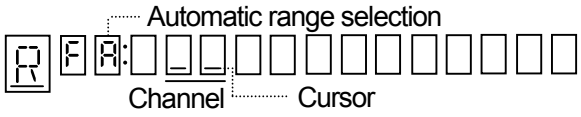
2. Programming mode

1) Display 1 (Printing format check)



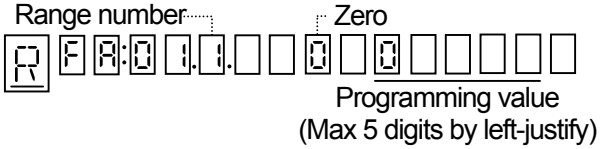
Dots appear at the selected format.
By pressing [SET END] key, the dots disappear and the cursor appears.

2) Display 2 (Programming channel)



By selecting automatic range-shift (Ar), the cursor appears at the channel programming position.

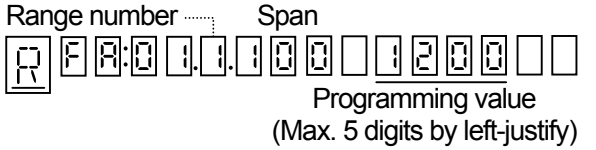
3) Display 3 (Zero programming in No. 1 range)



①Default programmed value is the lower-limit value of [range/printing range], but it can be programmed optionally.

②After the end of all programmings, return to the this display and execute [storing].

4) Display 4
(Span programming in No.1 to 5 ranges)

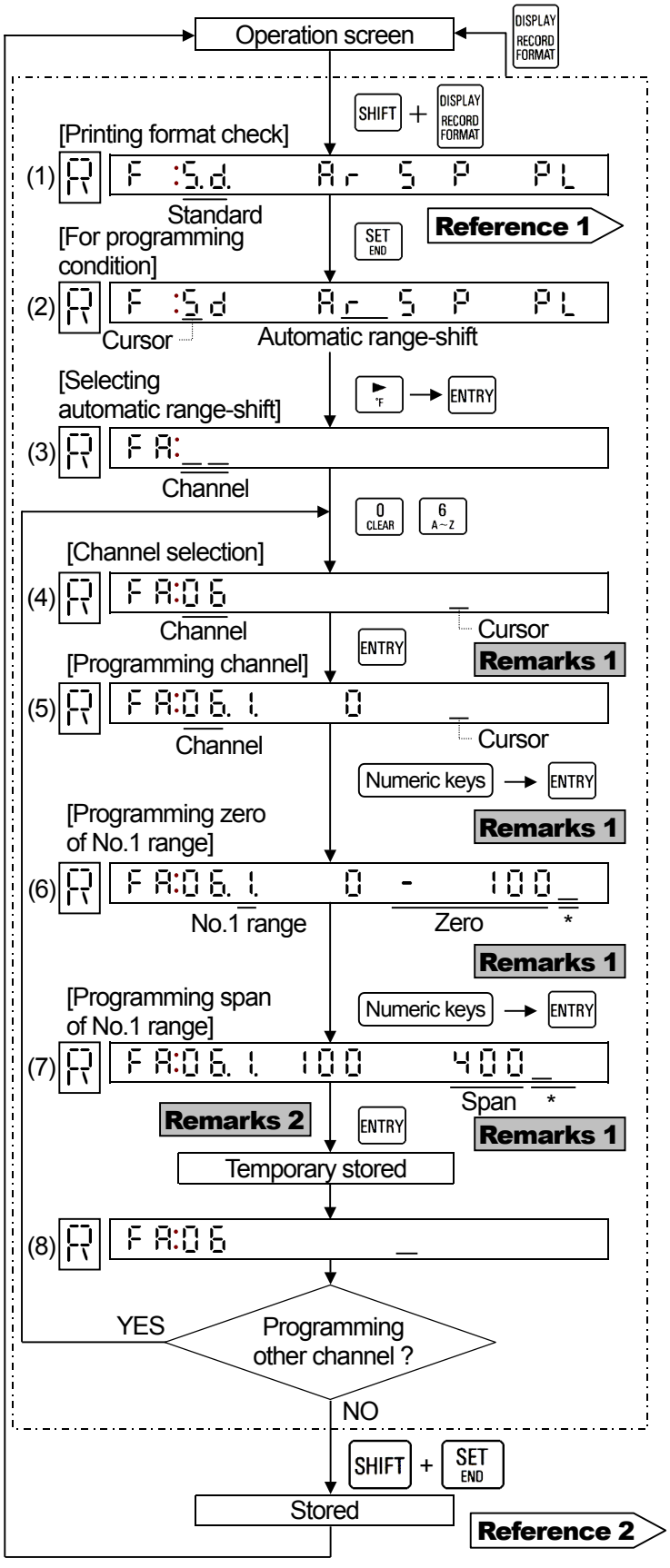


① By programming span, range number advances. Program the span up to necessary range number.

②After pressing [entry] key up to range No.5, press [Entry] key again to return to Display 3.

3. Programming flow chart

<Example> Programming channel 06 to the example on the left page



Remarks 1 Remedial measure to error display

Press a key other than SHIFT key and reset. Display transfers to the next one, if normal.

Remarks 2 Programming in and after No.2 range

After programming the span, press [ENTRY] key, and the range number advances up to 5.
For unnecessary numbers, press [ENTRY] key to advance the range number up to 5.

Reference 1 Programming parameters

The check display appears when pressing [ENTRY] key. The programmed parameters are displayed sequentially each time [ENTRY] key is pressed.
The channel is shifted to the other channels by ▲ or ▼ key.

Reference 2 Storing

Programmed are stored into memory. (Programming change mark is printed.)

Reference 3 Cancellation of programming

For canceling the stored parameters, clear it by pressing (SHIFT + 0 CLEAR) keys in the display in step ④ to ⑦ , and store by pressing [ENTRY] key.

Reference 4 Method of reprogramming to standard printing

Shift the cursor to (Sd) in step ② , and press [ENTRY] key.
For reprogramming to the automatic range-shift again, perform step ① to ③ and execute [storing].

Reference 5 Printings

Scale is printed in the order of channels. Range numbers (R1 to R5) are also printed.

*Fill surplus digits with a space.

Other channel programming

For other channels, repeat the same procedure form [channel selection].

14.2. Programming Compressed and Expanded Printing

Programming display appears at optional printing format only. This programming is to print compressed or expanded partially.

1. Compressed and expanded printing

A specified range of the trace printing range can be printed compressed or expanded.

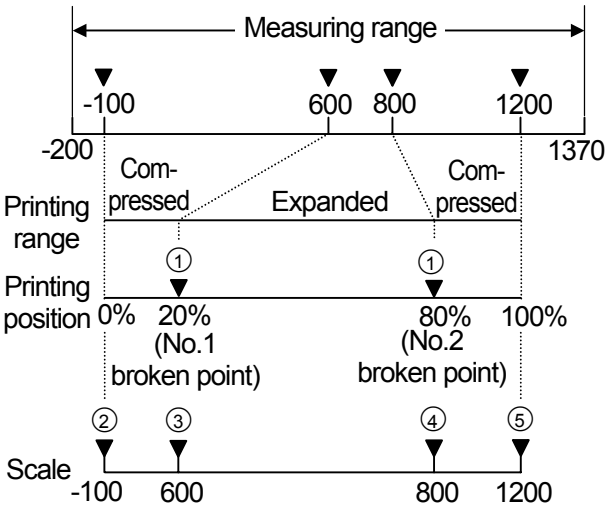
①This programming can be done for each channel.

②The printing range can be programmed optionally, irrespective of programmed value of the [range/printing range].

③Two broken points can be programmed.

A programming example of compressed and expanded printing.

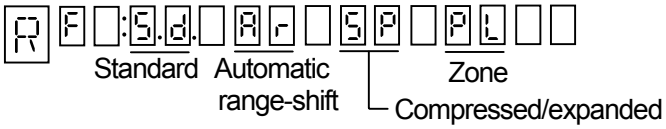
<In case of range No. 23 (K thermocouple)>



Mark ▼ shows the programming point and ① to ⑤ show the programming sequence. Press [Entry] key each time programming ends and the operation is transferred to the next programming display. (Program No. 1 broken point and No. 2 broken point by 2 digits. <Example> 5% → 05)

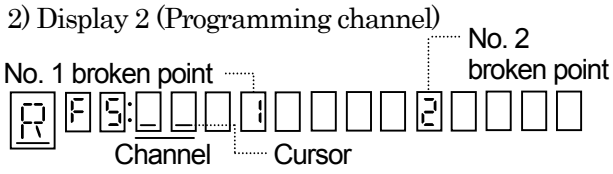
2. Programming mode

1) Display 1 (Printing format check)



Dots appear at the selected format.
By pressing [SET END] key, the dots disappear and the cursor appears.

2) Display 2 (Programming channel)



By selecting compressed/expanded (SP), the cursor appears at the channel programming position.

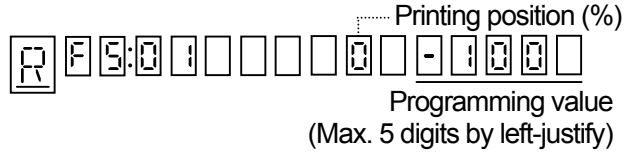
3) Display 3
(Programming broken point-printing position)

①Program each broken point printing position (%) by 2 digits.

②After the end of all programmings, return to the this display and execute [storing].

(Note) No. 1 broken point < No. 2 broken point must be satisfied as a requirement. Space No. 2 broken point, if not necessary.

4) Display 4
(Scale programming of each printing position)

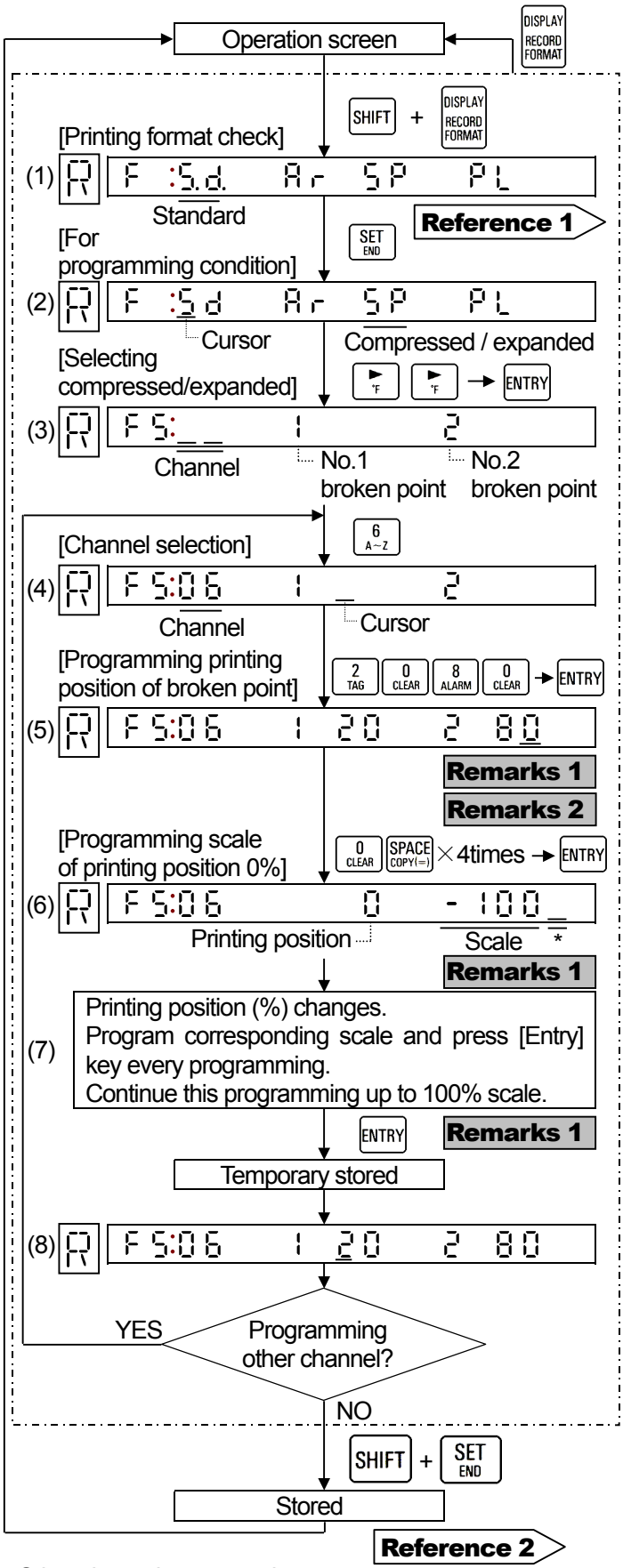


①By programming scale, printing position changes. Program the scale up to 100%.

②After programming 100% scale, press [Entry] key again to return to Display 3.

3. Programming flow chart

<Example> Programming channel 06 to the example on the left page



Remarks 1 Remedial measure to error display

Press a key other than [SHIFT] key and reset. Display transfers to the next one, if normal.

Remarks 2

If No. 2 broken point is not necessary, keep it spaced, and press [ENTRY] key.

Reference 1 Programming parameters

The check display appears when pressing [ENTRY] key. The programmed parameters are displayed sequentially each time [ENTRY] key is pressed.
The channel is shifted to the other channels by [▲] or [▼] key.

Reference 2 Storing

Programmed are stored into memory. (Programming change mark is printed.)

Reference 3 Cancellation of programming

For canceling the stored parameters, clear it by pressing ([SHIFT] + [0 CLEAR]) keys in the display in step ④ to ⑦, and store by pressing [ENTRY] key.

Reference 4 Method of reprogramming to standard printing

Shift the cursor to (P S) in step ② , and press [ENTRY] key. For reprogramming to the compressed and expanded again, perform step ① to ③ and execute [storing].

Reference 5 Printings

Scale of each printing position is printed like -100/600/800/1200.
Mark [+] is printed at the broken point printing position.

*Fill surplus digits with a space.

Other channel programming

For other channels, repeat the same procedure form [channel selection].

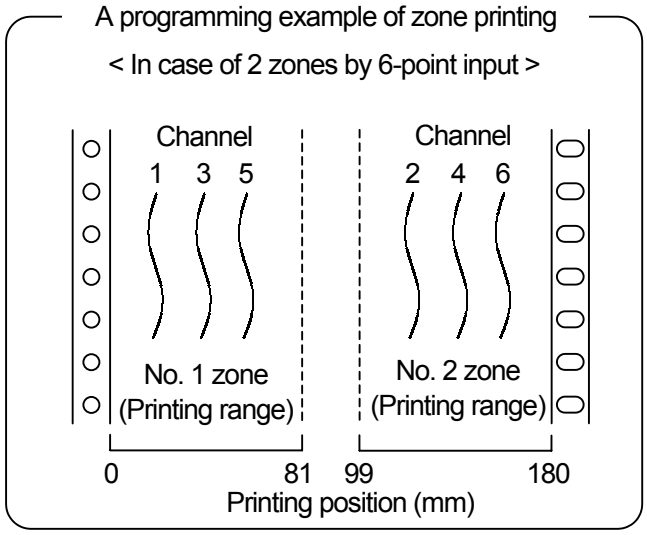
14.3. Programming Zone Printing

Programming display appears at optional printing format only. This programming is to divide trace printing into 2 to 4 zones.

1. Zone printing

The trace printing is divided into two to four zones which can optionally be selected for printing. This is effective when printing overlaps each other.

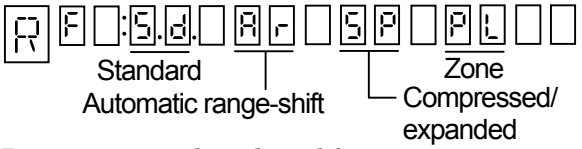
①The printing can be selected for each channel.
②The printing range of each zone is programmed to the printing range being programmed in [range/printing range].
③The example below shows printing position(mm) at the number of zone.



Number of zones	No.1 zone	No.2 zone	No.3 zone	No.4 zone
2	0 to 81	99 to 180		
3	0 to 54	63 to 117	126 to 180	
4	0 to 36	45 to 81	99 to 135	144 to 180

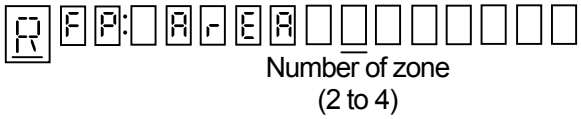
2. Programming mode

1) Display 1 (Printing format check)

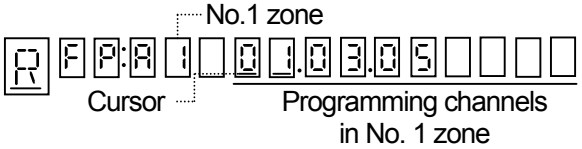


Dots appear at the selected format.
By pressing [SET END] key, the dots disappear and the cursor appears.

2) Display 2 (Programming zone number)

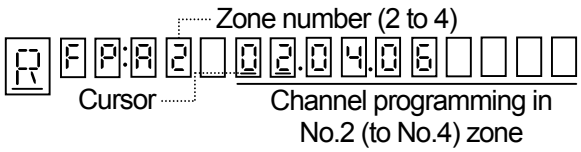


3) Display 3
(Programming channels in No. 1 zone)



⌐ : In case of sequential channels
● : In case of non-sequential channels

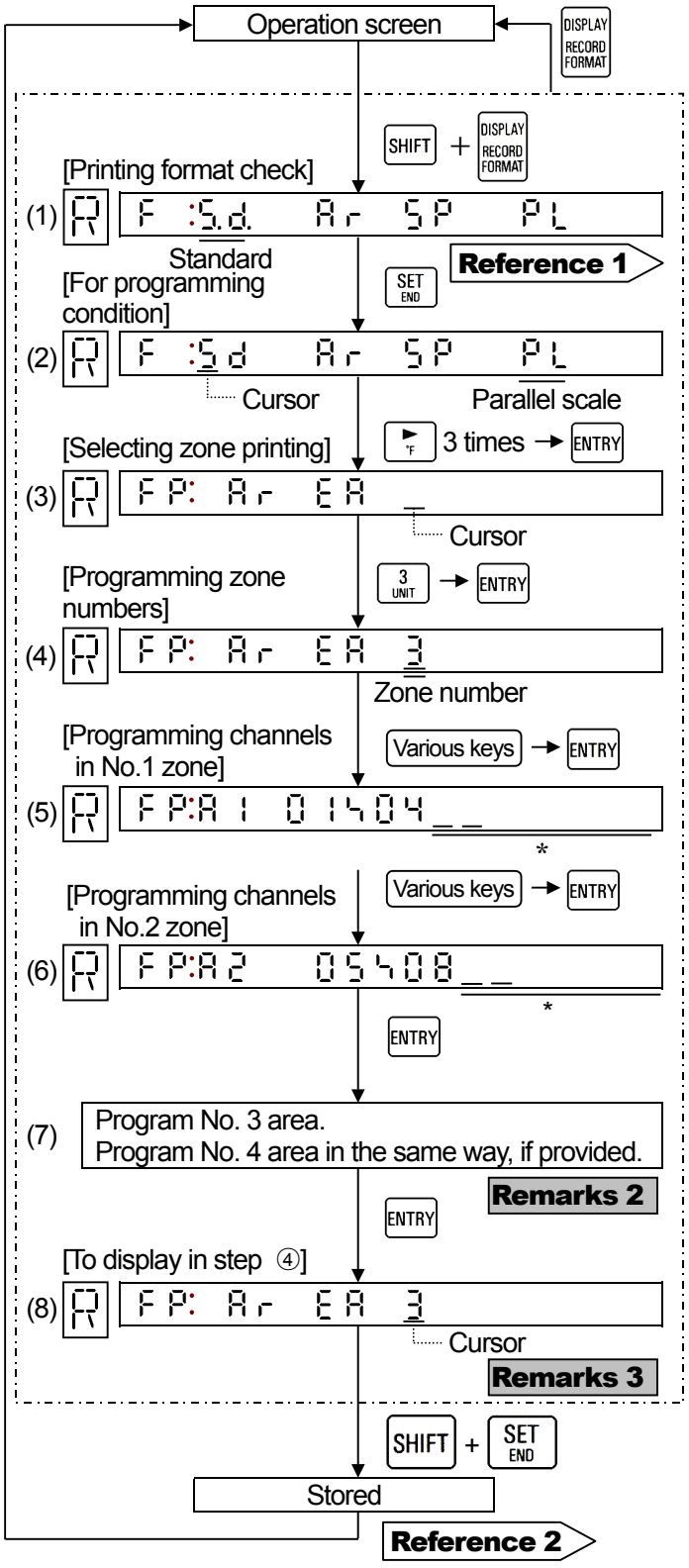
4) Display 4
(Channel programming in No.2 to No.4 zones)



⌐ : In case of sequential channels
● : In case of non-sequential channels

3. Programming flow chart

<Example> Program CH 01 to 04 to zone 1, CH 05 to 08 to zone 2 and CH 09 to 12 to zone 3 on 12-point



Remarks 1 Countermeasure against error display

If an error display appears during programming, reprogram it by pressing a key other than SHIFT .
Display transfers to the next one, if normal.

Remarks 2 Channel programming in No. 3 and 4 areas

If the division number is 3 or 4, the areas are displayed by the division number.
Program the channels in each area.

Remarks 3 Display in step ④ for storing

Display in step ④ should be appeared for storing.

Remarks 4 Channel selection and overlap

Channels not selected for any area are skipped. A programming error occurs if channels are selected doubly or if skipped channels are selected.

Reference 1 Programmed contents check

The check display appears when pressing ENTRY key.
The programmed parameters are displayed sequentially each time ENTRY key is pressed.

Reference 2 Storing

Programmed values are stored into memory.
(Programming change mark is printed.)

Reference 3 Printings

The zone boundary is printed with ' + ' in the trace printing range.

*Fill surplus digits with a space.

15. OTHER OPTIONS

15.1. High-Speed Trace Printing

Selecting display appears at optional high-speed trace printing only. The trace printing interval can be selected out of about 5 sec. (standard trace printing) or about 2.5 sec. (high-speed trace printing).

Renewal intervals of measured value

Multi-point sequential display	Multi-point sequential	Advances channels in about 5sec.
	One-point continuous	About 5sec.
Multi-point simultaneous display	6-point input	About 5sec./6 points
	12-point input	About 10sec./ 12 points
	24-point input	About 20 sec./ 24 points

1. The renewal intervals of measured data on high-speed trace printing and standard trace printing are same.
2. The intervals depend on more or less upon the measuring conditions (overrange, skip, etc.).

Printing intervals of high-speed trace printing

The trace printing intervals are restricted by the following formula when the chart speed is slower than a certain value for the purpose of preventing overlapped printing.

$$\text{Printing interval (sec)} = \frac{180}{CS \times CH}$$

C S: Chart speed (mm/h)

CH: Channel numbers (excluding skipped channels)

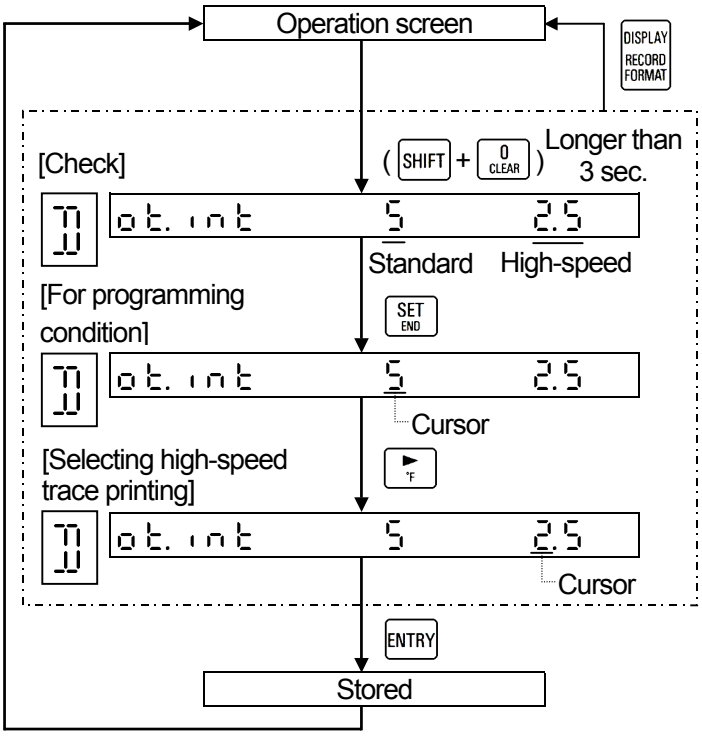
The printing interval of lower than 2.5(sec.) becomes 2.5 sec. and a decimal value is carried up.

<Trace printing intervals on 6 channels>

Chart speed	Intervals	Chart speed	Intervals
1	30 sec.	6,7	5 sec.
3	10 sec.	8,9	4 sec.
5	6 sec.	10,11	3 sec.

1. Selecting flow chart

<Example> Standard trace printing → high-speed trace printing



Remarks Use at high-speed trace printing

The trace-printing intervals become short. If measured values change a little, trace printings may overlap each other to cause the chart to be broken. Select the standard trace printing if measured values change a little.

Reference 1 Confirmation

The selected trace printing interval value flickers.

Reference 2 Storing

Store the selected trace printing interval into memory.
(Programming change mark is printed.)

15.2. Shunt Resistor for Current Input

A DC current input can be measured by connecting a shunt resistor (option) to the input terminals and converting the current input into a voltage level.

1. Shunt resistor (option) and measuring current range

・A shunt resistor converts a DC current input into a DC voltage. Two kinds of resistors are available as shown in the right table.

・The measuring current ranges by two kinds of shunt resistors are as specified in the right table.

Shunt resistor and measuring range

Code	Resistance value*	Measuring range
BZ-RX100	100Ω	±50mA DC
BZ-RX250	250Ω	±20mA DC

＊Accuracy : 100Ω --- Rated value ± 0.05%
250Ω --- Rated value ± 0.1%

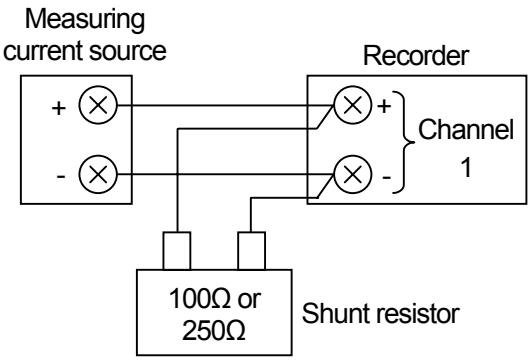
2. Connections

Connect a shunt resistor to each measuring channel for a DC current input.

Remarks Cautions on connections

Connect one shunt resistor to one channel.

<Example> Connect a shunt resistor to channel 1



3. [Range/printing range] and [scale]

1) Range number

Range number is 07, since the conversion voltage by each shunt resistor is ±5V.

2) Printing range

Program the printing range by the voltage-converted value.

・Lower-limit value = Lower-limit current × shunt resistor's value

・Higher-limit value = Higher-limit current × shunt resistor's value

3) Scale

Program the scale by the physical quantity to a current input.

・Lower-limit value = Physical quantity of the lower-limit current

・Higher-limit value = Physical quantity of the higher-limit current

Range number to be used

Resistance value	Measuring range	Converted voltage	Range No.
100Ω	±50mA DC	±5V DC	07
250Ω	±20mA DC	±5V DC	07

Printing range example

<Desired trace printing input 4 to 20mA>

Use 250 Ω shunt resistor, since the maximum measuring current is 20 mA.

・Lower-limit value = 4(mA) × 250(Ω) = 1(V)

・Higher-limit value = 20(mA) × 250(Ω) = 5(V)

An example of scale programming

<Physical quantity of 4 to 20 mA is 0 to 500 ℓ / m²>

・Lower-limit value = 0

・Higher-limit value = 500

15.3. Mathematical Function and Totaliser

1. Option of mathematical functions

①Mathematical functions is to carry out mathematical functions to measured data, and to display and to record the result.

②There are 11 kinds of mathematical functions as shown in the following table, which can be selected to optional channels.

1. No mathematical functions	: non	7. Extraction of the square root	: root
2. Arithmetic 1	: mUL	8. Temperature and humidity	: HUmidity
3. Arithmetic 2	: diV	9. Maximum value	: Hi PEAK
4. Natural logarithm	: LoGE	10. Minimum value	: LoPEAK
5. Common logarithm	: LoG10	11. Average	: AVErAGE
6. Exponent	: PoWEr	12. Data communications input	: Comm in *

*It can be selected only when adding a composite option with the communications interface.

<Exclusive instruction manual>

The following instruction manual is separately added. For details, read the instruction manual.
Instruction manual, [Math] and [Totaliser] Version INST. no. INE-289.

2. Option of totaliser

①Totaliser is to carry out totalising the measured data, and to display and to record the result.

②The totaliser can be selected to optional channels with the display of "int".

<Exclusive instruction manual>

The following instruction manual is separately added. For details, read the instruction manual.
Instruction manual, [Math] and [Totaliser] Version INST. no. INE-289.

16. ADJUSTMENT

16.1. Adjustment of Measuring Values

Kinds of adjustment

Adjustment comprises three kinds shown below. ① and ③ have been already adjusted. However, it is recommended for maintaining the measuring and printing accuracy to adjust them once every year.

Calibration	Contents	Method
①Measured value adjustment	Adjustment for maintaining measuring values corresponding inputs to be within accuracy rating.	par.16.1
②Shift programming of measured value	Programming to shift a measured value.	par. 16.2
③Adjustment of trace printing position	Adjustment to set the trace printing range to zero and span of the chart.	par. 16.3

1. Adjustment of measured values

It is recommended for maintaining the measuring and printing accuracy to adjust them once every year.
①Adjust measured values for each input channel.
②Adjust measured values under the reference condition.
(See the right table)

Reference conditions

Items	Reference conditions
Ambient temperature	23± 2°C
Ambient humidity	55± 10%RH
Power voltage	100VAC ± 1%
Power frequency	50 or 60 Hz ± 0.5

2. Preparation

1) Preparation of tools

Tools	Input types			Remarks
	DC voltage	Thermocouple	Resistance thermometer	
DC standard voltage/current generator	○	○		Accuracy: Shall be better than ±0.05%
Reference junction compensator		○		0°C ± 0.2°C
Thermocouple for test		○		Same type of thermocouple as input type
Standard variable resistor			○	Accuracy: Shall be better than ±0.05%
3-core copper wire			○	Three copper wires shall have the same resistance value.

2) Connections

Connections depend upon the input types. See the next page.

3) Before starting adjustment

①Mount the terminal board cover and turn on the power supply.
②Warm up the instrument for longer than 30 minutes until it is stabilized before starting adjustment.
(It is recommended to warm up the instrument for longer than one hour.)

Remarks Adjustment

Checking and adjustment of measured values require careful work with a standard tool and other tools employed under the reference conditions. For asking us for the checking and adjustment work of measured values, please contact our sales agent.

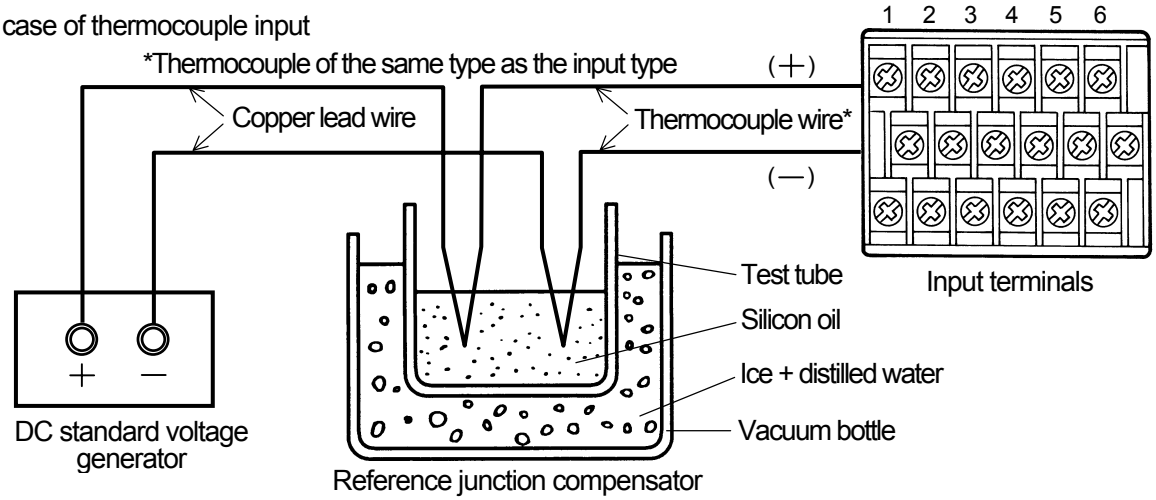
3. Connections

Connections depend upon the input types.
Connect a standard tool and other tools to the measuring input terminals to be adjusted.

Caution Turn off the source power supply before starting connections

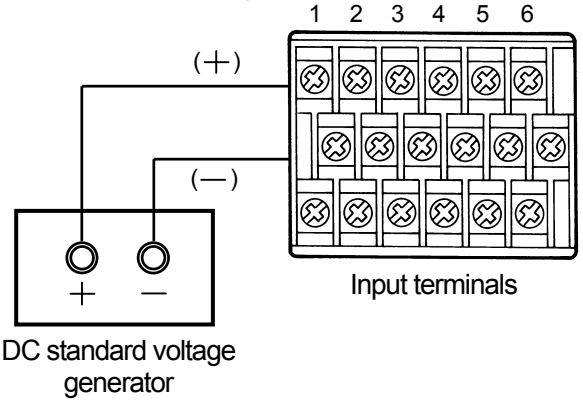
Turn off the source power supply before starting connections for the purpose of preventing an electric shock accident.

①In case of thermocouple input

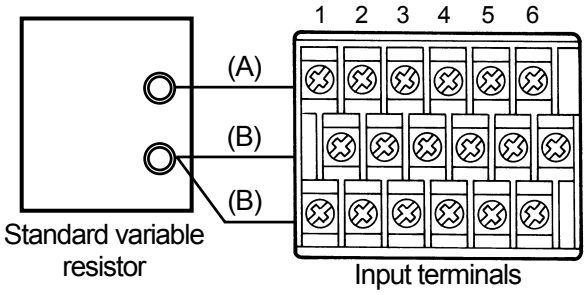


The electromotive force of the thermocouple input becomes small by the electromotive force equivalent to the temperature at terminals. The instrument itself compensates for the electromotive force equivalent to the temperature at terminals. This is called reference junction compensation. Accordingly, the reference junction compensator is necessary for reducing the electromotive force compensated.

②In case of DC voltage input

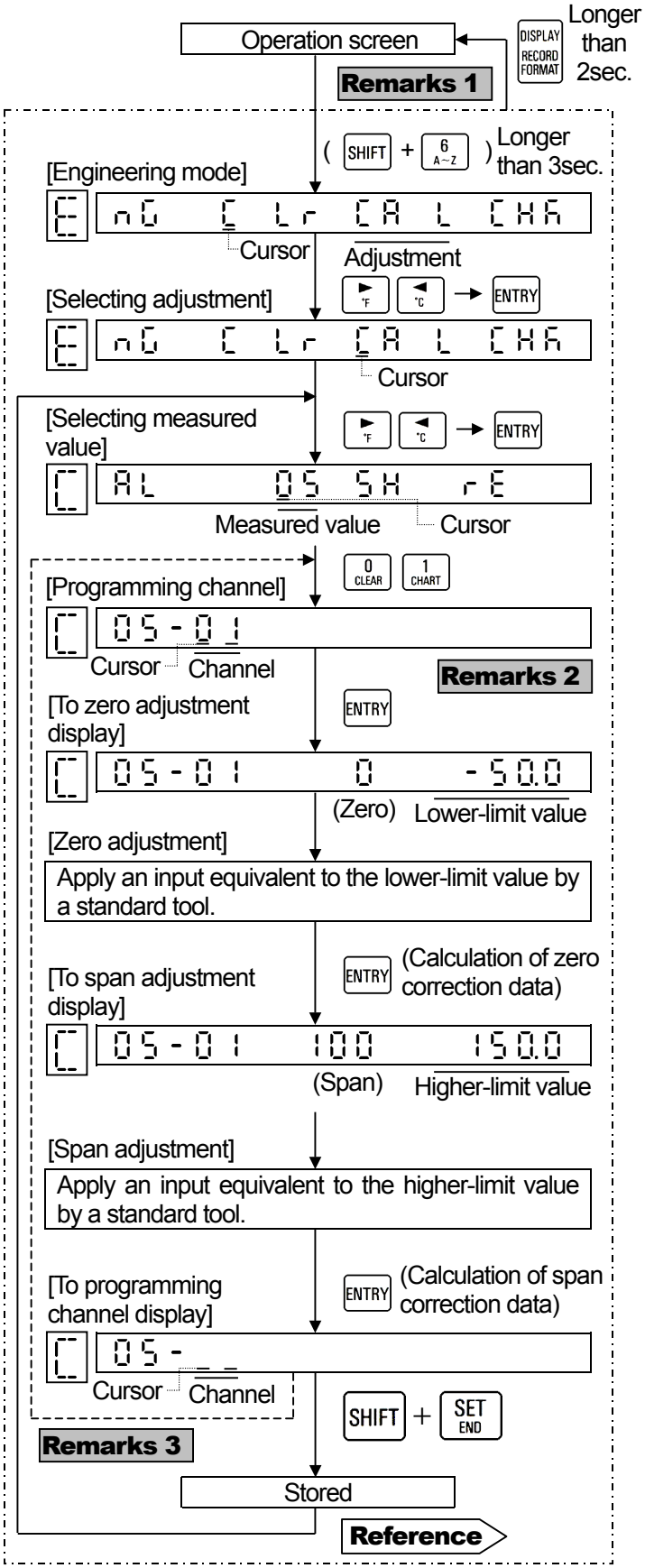


③In case of resistance thermometer input



4. Programming flow chart

<Example> Adjustment of channel 01 (printing range -50 to + 150)



Remarks 1 For returning to operation screen

Calculated correction data are canceled by returning to the operation display at the procedure before [storing].

Remarks 2 Skipped channel does not accept any ENTRY key

When a skipped channel is programmed, it does not accept the ENTRY key.

Remarks 3 Other channels adjustment

After reconnecting to input terminals to be adjusted, repeat the same procedure line from the programming channel display (indicated by a dotted line).

Remarks 4 Initialization of correction data

By pressing ENTRY key after clearing (by pressing SHIFT + 0 CLEAR keys) in zero adjustment or span adjustment display, the correction data of the channel becomes the initial value.

Reference Storing

Store the calculated correction data into memory.

16.2. Shift Programming of Measured Values

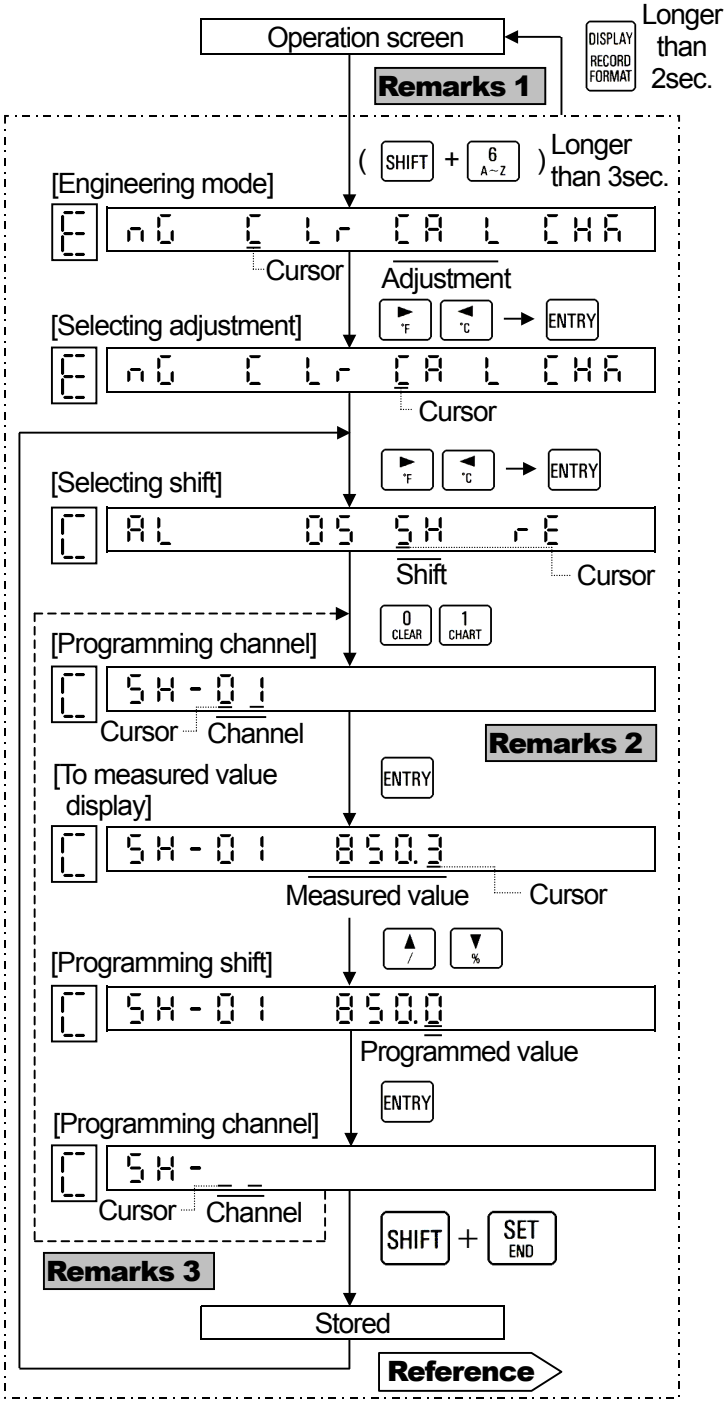
This programming is executed when it is desired to change a measured value slightly and the subsequent measured values become the shifted values.

1. Shift programming

①This programming is executed for each channel.
②The cursor shifts to the least significant digit. Perform this programming by [▲/] , [▼%] keys.

2. Programming flow chart

<Example> Shift measured value 850.3 in channel 01 to 850.0



An example of shift programming

Measured value ------ 850.3 Cursor

▼% ×3 times ⇩

Programming ------ 850.0 Cursor

Shift value = 850.0-850.3 = -0.3

Before programming

Wait for longer than 30 minutes before starting this programming after turning on the power supply.

Remarks 1 For returning to operation screen

Shift value is canceled by returning to the operation display at the procedure before [storing].

Remarks 2 Skipped channel does not accept any ENTRY key

When a skipped channel is programmed, it does not accept the ENTRY key.

Remarks 3 Other channels adjustment

After reconnecting to input terminals to be adjusted, repeat the same procedure line from the programming channel display (indicated by a dotted line).

Remarks 4 Initialization of shift value (0)

By pressing ENTRY key after clearing (by pressing SHIFT + 0 CLEAR keys) at the procedure after channel programming, the channel shift value becomes 0.

Reference Storing

Store the programmed shift value into memory.

16.3. Adjustment of Trace Printing Position

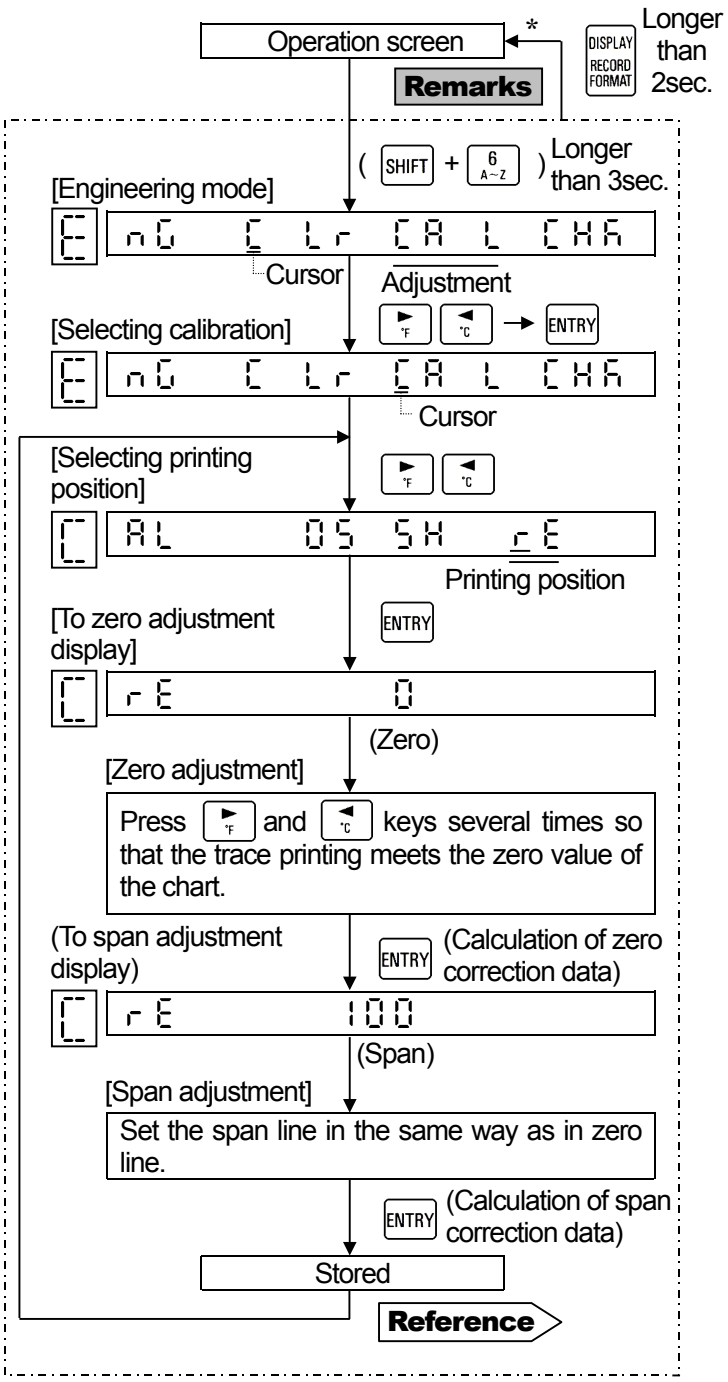
Zero and span adjustment at trace printing position can be done. It is recommended for maintaining the printing accuracy to adjust the trace printing position once every year.

1. Zero and span adjustment

Adjustment can be done by pressing [ENTRY] key at the position where the trace-printing position has been met.

・This adjustment does not interfere with the adjustment of measured values.

2. Adjustment flow chart

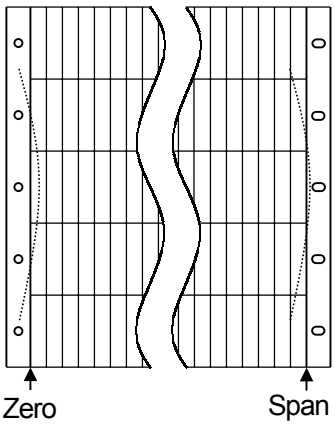


Adjustment procedure

①Perform trace printing while feeding the chart.

②Trace printing shifts rightward bit by bit, each time [°F] key is pressed once. Trace printing shifts leftward bit by bit, each time [°C] key is pressed once.

③Press [ENTRY] key when trace printing meets zero or span line.



Remarks For returning to operation screen

Calculated correction data are canceled by returning to the operation display at the procedure before [Storing].

Reference Storing

Store the calculated correction data into memory.

* [DISPLAY RECORD FORMAT] key is not acceptable during zero.span adjustment is displayed.

17. HARDWARE CHECK

17.1. ROM Version Check

Kinds of hardware check

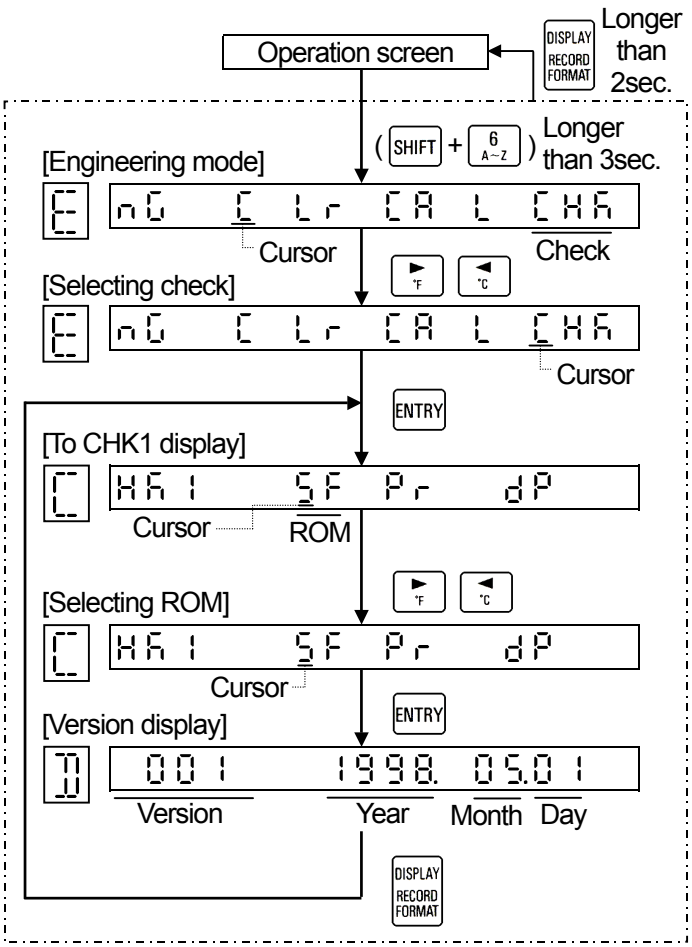
Hardware check comprises the following six kinds. Items ④ and ⑤ apply to the instrument with the alarm output plus remote contacts (option) functions.

Check name	Contents	Methods
①ROM version check	ROM version can be confirmed.	Par. 17-1
②Printer test	Printer can be tested.	Par. 17-2
③Display test	Lamps, and segment of the display board can be tested.	Par. 17-3
④Alarm output check	An ON or OFF signal can be output from terminals.	Par. 17-4
⑤Remote contacts input check	The input condition (open or short condition) of terminals can be checked.	Par. 17-5
⑥Communications interface check	Communications (sending, receiving) can be checked.	*

*Refer to the separate instruction manual for [communications interface].

1. Check flow chart

ROM version can be checked.



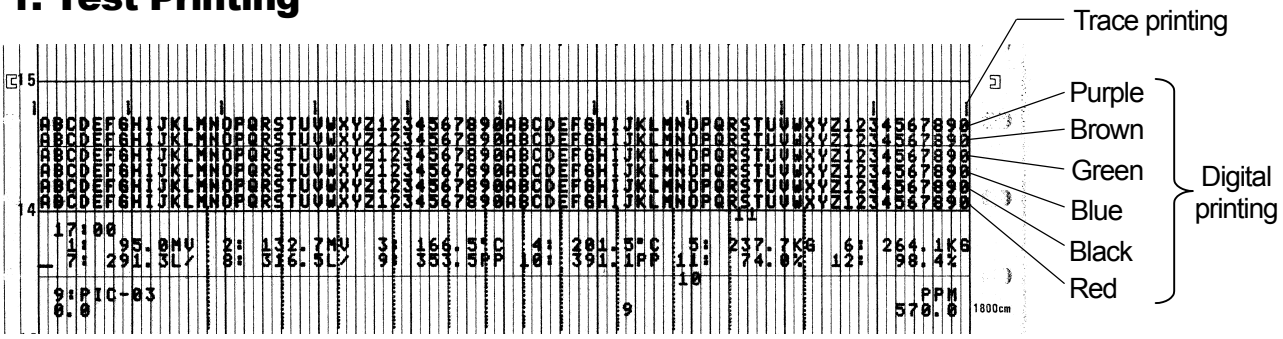
Reference ROM label

ROM is mounted on CPU board.
A label showing the version number is also stuck to ROM.

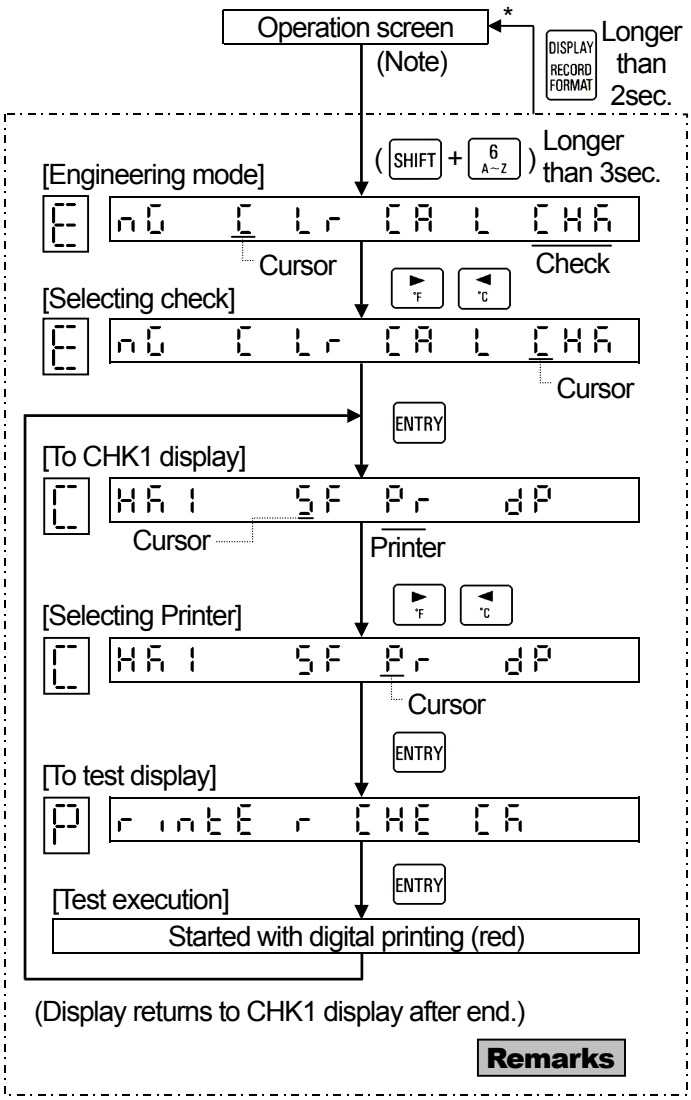
17.2. Printer Test

The printer can be tested.

1. Test Printing



2. Test flow chart



Test printing contents

1. Digital printing
- 72 characters (repetition of A to Z, 1 to 9,0) are printed on one line.
- Same characters are printed in 6 lines.
- Each line is printed in the order of trace printing colors.

2. Trace printing
- Trace printing is done by 11 rows at intervals of 10% within a range of about 0% to 100%.
- Chart is fed 0.1 mm once every line (11 dots).
- Trace printing is done in the order of trace printing colors every 1 lines.
- Trace printing is executed by 6 lines in total.

(Note) After loading the chart, turn on printing.

Remarks For stopping the test

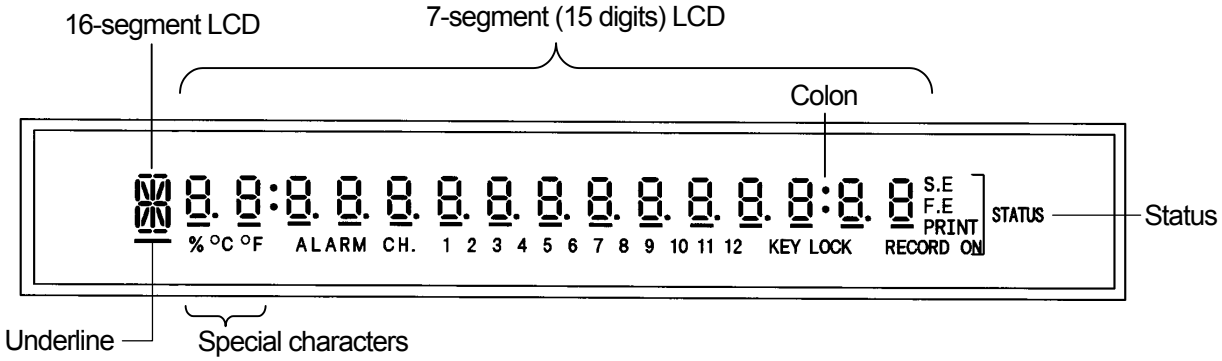
It takes about 8 minutes to complete all printings. For stopping printing halfway, press RECORD ON/OFF → ENTRY keys.
The display returns to CHK1 display after the end of one line.

* DISPLAY RECORD FORMAT key is not acceptable during the execution of test.

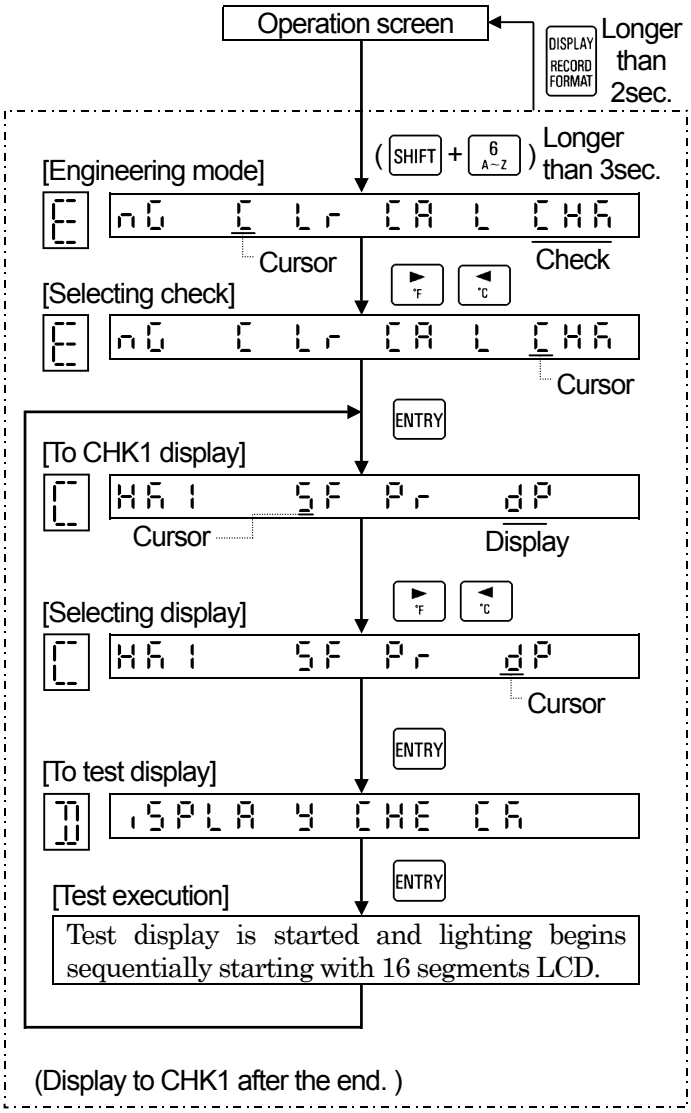
17.3. Display Test

The display can be tested by sequentially lighting 16 and 7- segment LCDs and status displays.

1. Display ....The following figure shows the multi-point sequential display.



2. Test flow chart

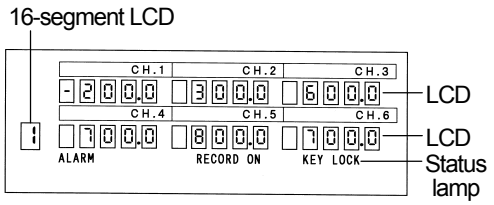


Lighting sequence

1. 16 segments LCD
2. 7 segments display
   ……From left to right
3. Status lamps

In case of multi-point simultaneous display

Lower LCDs light sequentially from left to right and the upper LCDs light in the same way. Then, the status lamps light. In case of 12-point and 24-point input, the right and left displays advance concurrently.

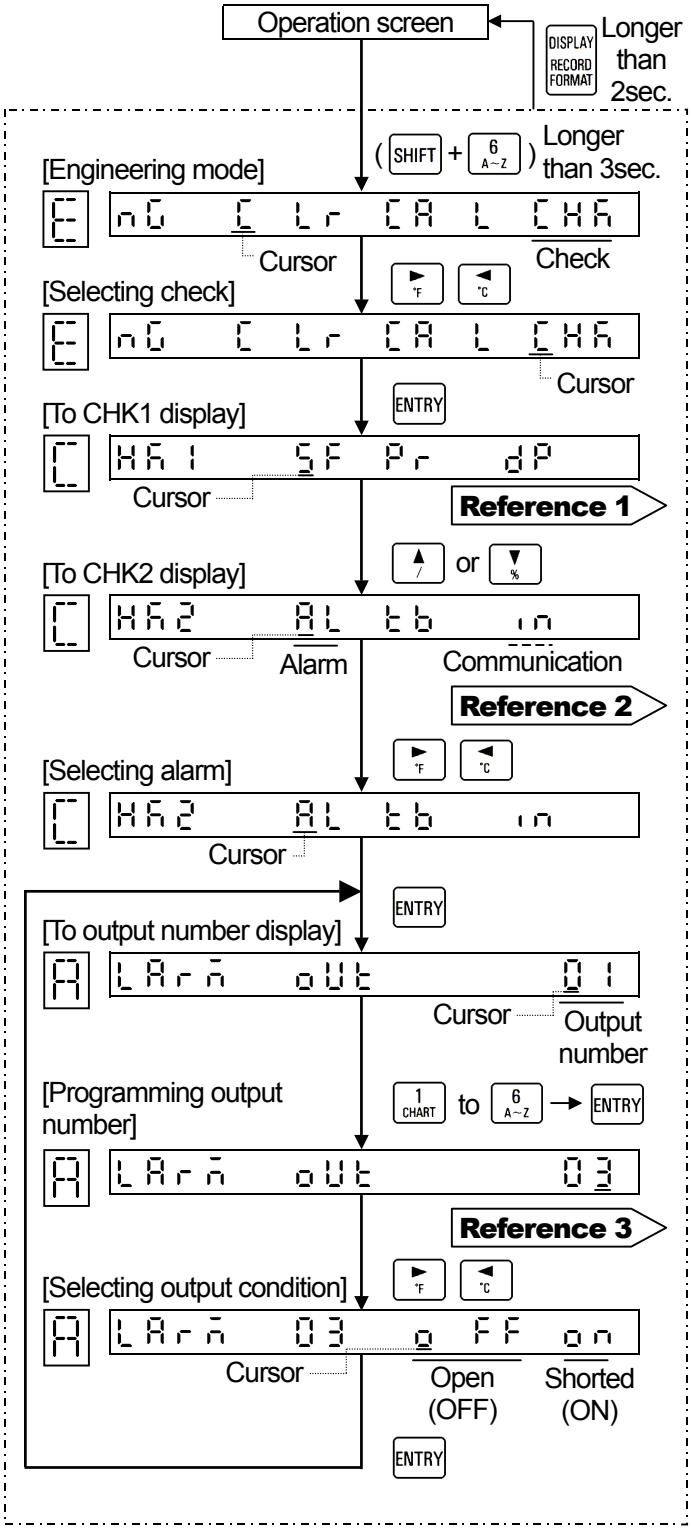


17.4. Alarm Output Check

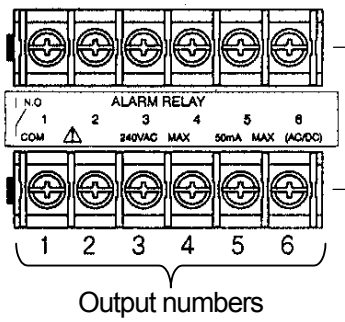
This check applies to the instrument with an alarm output function (option) only. Alarm outputs can be checked by outputting either shorted (ON) or open (OFF) signal from specified alarm output terminals.

1. Check flow chart

<Example> Alarm output No. 03 check



Alarm output terminals (No. 01 to No. 06)



* The above figure shows MOS relay output and CE mechanical relay 'a' contact output.

Resistance value across terminals

Output	Output condition	N.O-COM
MOS relay	OFF	Higher than 10MΩ
	ON	Lower than 50Ω
Mechanical relay ('a' and 'c' contact common)	OFF	Higher than 10MΩ
	ON	Lower than 0.1Ω

Reference 1 CHK1 and CHK2 display selection

CHK1 and CHK2 are switched by ▲/ or ▼% key.

CHK2 can be selected only when options (alarm output + remote contacts or communications interface) are added.

Reference 2 Communications interface check.

Refer to the separate instruction manual for [communications interface].

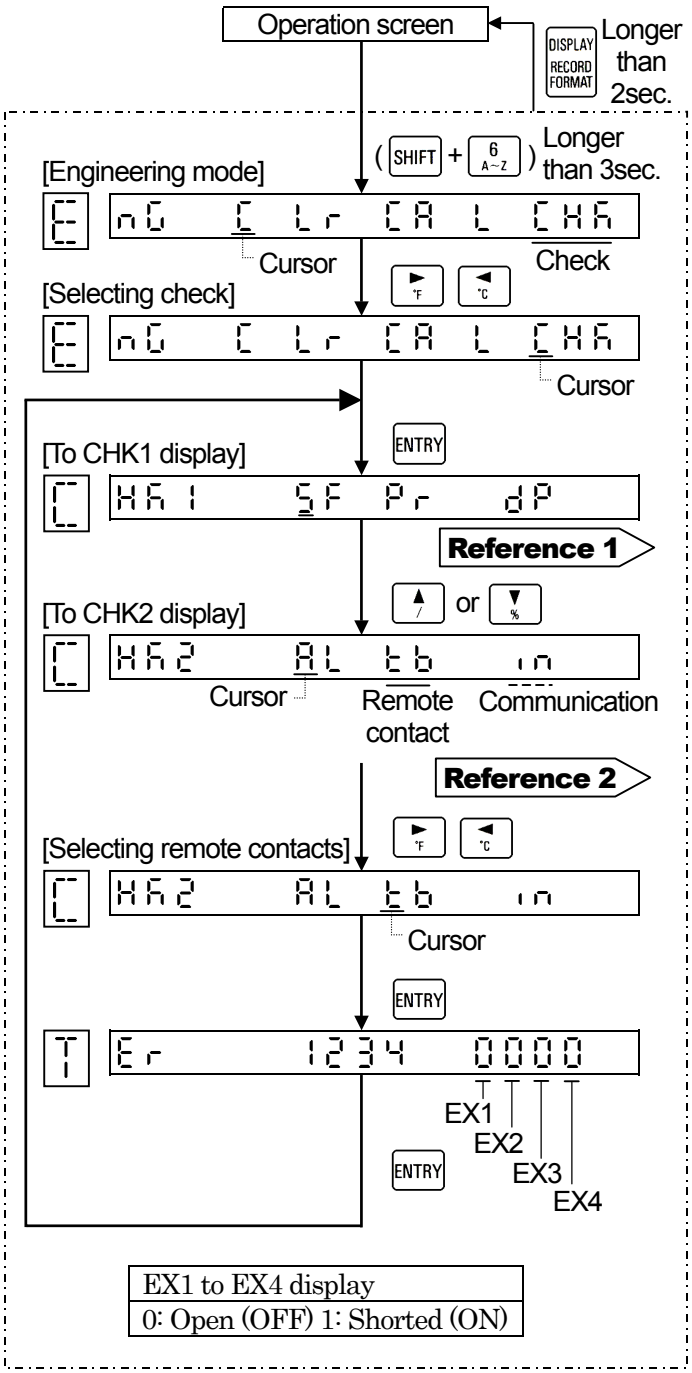
Reference 3 Output condition

The condition (OFF/ON) being selected by ►°F or ◄°C key is output.

17.5. Remote Contacts Input Check

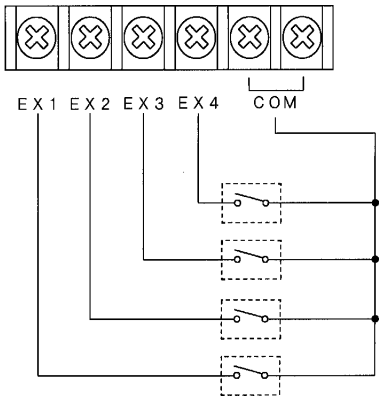
This check applies to the instrument with a remote contacts function (option) only. Input signals (shorted/ open) of remote contacts terminals can be checked.

1. Check flow chart



EX1 to EX4 display
0: Open (OFF) 1: Shorted (ON)

Remote contacts terminals



Remote contacts signals and functions

Conditions to COM terminals				Functions	
EX1	EX2	EX3	EX4		
0	0	0	0	CS1	Printing ON
1	0	0	0	CS2	
0	1	0	0	CS3	
1	1	-	-	Printing off	
Printing ON		1	0	Digital data printing	
		0	1	List printing	

0 : Open 1 : Shorted

Reference 1 CHK1 and CHK2 display selection

CHK1 and CHK2 are switched by [▲/] or [▼/%] key.

CHK2 can be selected only when options (alarm output + remote contacts or communications interface) are added.

Reference 2 Communications interface check

Refer to the separate instruction manual for [communications interface].

18. PROGRAMMING INITIALIZE

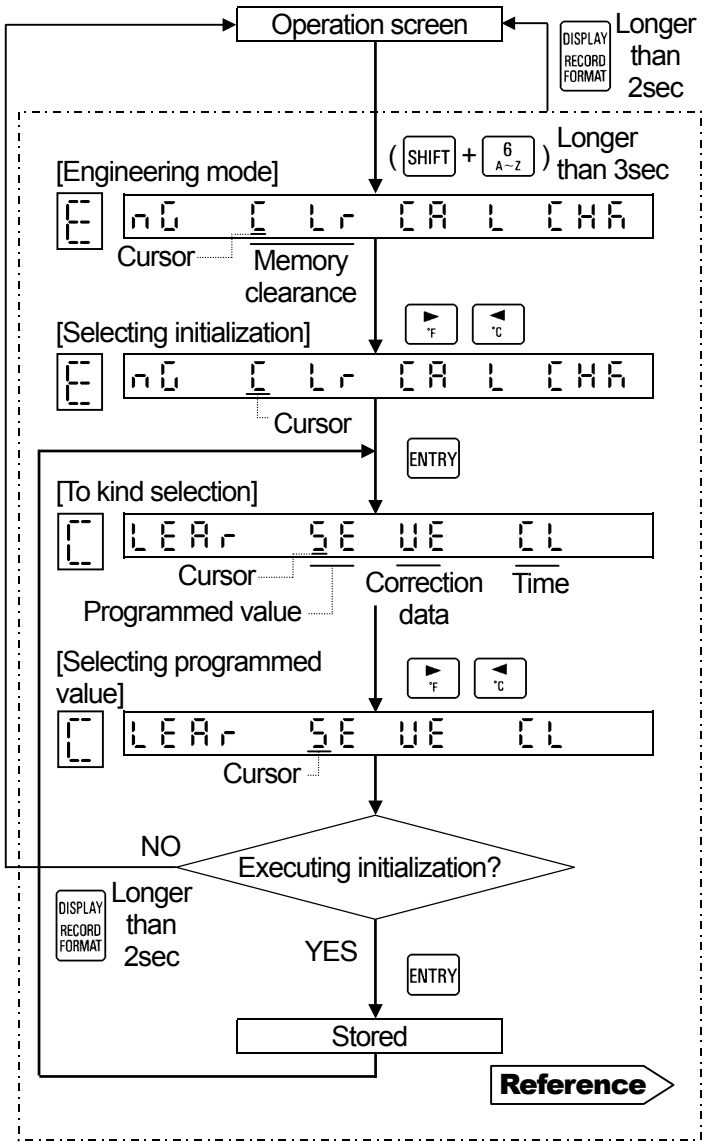
Programmed values and correction data after calibration can be initialized to the default values.

1. Kinds of initialize

Kinds	Initializing contents and cautions
Programmed values	Initializes all programmed values excluding [time] to the default values. For the default values list, see par. 7.2.
Correction data	Initializes all calibrated correction data to the default values. Correction data may be programmed to trace printing zero and span at the delivery time. (Caution) Don't initialize any correction data, except for unavoidable circumstances.
Time	Initializes time to 00:00 hours on January 1, 1998. The time is preprogrammed to the Japanese time at the delivery time. Initializes the time when the operation screen is not shown due to a failure of LSI for time.

2. Operation flow chart

<Example> Initialization of programmed values



Reference Storing

Execute initialization, store it into memory, and then, shift to the [kind selection].
Other kinds can be initialized, too.

19. MAINTENANCE/TROUBLESHOOTING

19.1. Routine Inspection

Check the residual quantity of chart, printing conditions, etc., and use the instrument under a good condition at all times.

1. Consumable parts check

<table>
<tr><th>Check items</th><th>Checking methods</th></tr>
<tr><td>1. Residual quantity of chart</td><td>Check the residual quantity of chart. When the residual quantity comes to an end, a message "Prepare the new chart" and an end mark appears on the right side. Replace the chart with a new chart.

<table>
<tr><td>Loading of chart</td><td>See par. 5.1.</td></tr>
<tr><td>Ordering of chart</td><td>See par. 1.2.</td></tr>
</table>

Reference Continuous printing days of chart
<table>
<tr><th>Chart speed</th><th>Continuous printing days of chart</th></tr>
<tr><td>25 mm/h</td><td>About 32 days</td></tr>
<tr><td>50 mm/h</td><td>About 16 days</td></tr>
<tr><td>100 mm/h</td><td>About 8 days</td></tr>
</table>
</td></tr>
<tr><td>2. Cassette ribbon</td><td>Replace the cassette ribbon when the printings have become thin.
The cassette ribbon can be used for about 3 months under the reference environment.
See par. 5.2.
<table>
<tr><td>Loading of cassette ribbon</td><td>See par. 5.2.</td></tr>
<tr><td>Ordering of cassette ribbon</td><td>See par. 1.2.</td></tr>
</table>
</td></tr>
</table>

2. Operation check

Check items	Check contents
Printing conditions	1. Feed condition of chart Check if chart is fed normally. 2. Printing condition Check if printings are normal.
Display conditions	Check if displays of measured values and status are normal.
Others	①Check if measured values are normal. ②Check the instrument for abnormal noises, abnormal odor, or other abnormal symptoms.

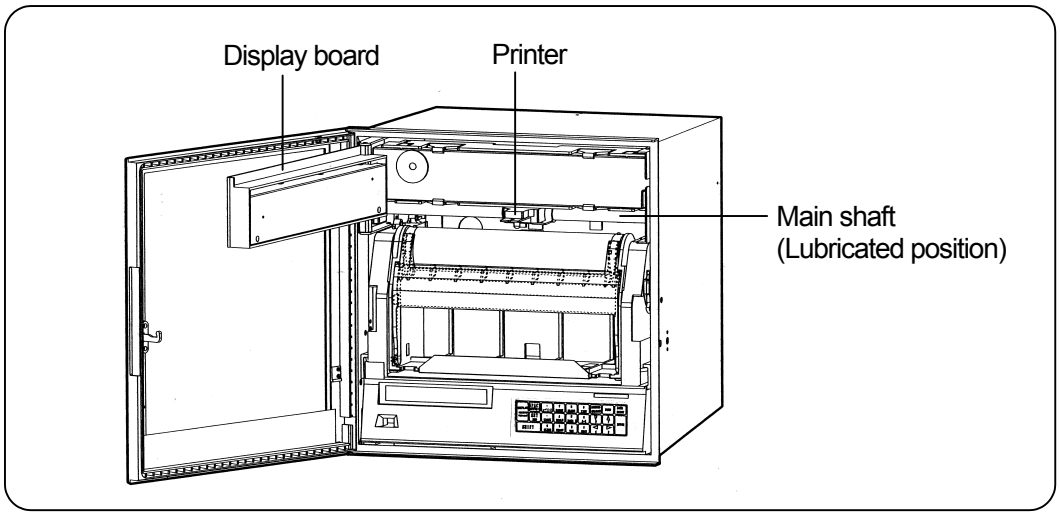
If a trouble was detected as a result of operation check, take remedial measures, referring to troubleshooting in par.19.4.

19.2. Lubrication and Cleaning ⚠

1. Lubrication

Lubricate the main shaft of the printer once every 6 months

①Turn off printing by pressing [RECORD ON/OFF] + [ENTRY] keys. (The printer stops at about the center)
②Turn off the power supply.
③Open the display board and remove the cassette ribbon. (See par. 5.2　3.)
④Remove dirt from the main shaft of printer with a soft cloth.
⑤Apply one or two drops of attached lubricating oil to the main shaft of the printer.



⚠ **Caution** Cautions on lubrication

①Don't move the printer rightward or leftward by hand.
②Use the attached lubricating oil. Don't use any other oil.
③Don't lubricate gears or other positions.

2. Cleaning

The door frame and front panel are made of plastics. Clean them with a dry soft cloth or with a soft cloth moistened with lukewarm water or a neutral detergent.

⚠ **Caution** Don't use any chemicals

Don't use thinner, benzine, or other chemicals that may melt plastics, otherwise the door and front panel may be deformed or broken.

19.3. Measuring Values Check ⚠

It is recommended for maintaining the measuring accuracy rating to check measuring values once every year.

1. Channels to be checked

Check measuring values for each channel. Errors may be different between channels even in the same range.

Remarks In case of math and/ or totalising channels

Check channels set to the mathematical function and/or totaliser (any of them optional) after once set the mathematical function to "non".

Reference conditions during check

Items	Reference conditions
Ambient temperature (Note)	23±2°C
Ambient humidity	55±10%RH
Power voltage	100VAC±1%
Power frequency	50 or 60 Hz ±0.5%

(Note) Add ±0.01% /1°C when the ambient temperature is other than 23±2 °C

2. Preparation

1) Preparation of tools

Tools	Input types			Remarks
	DC voltage	Thermocouple	Resistance thermometer	
DC standard voltage/current generator	○	○		Accuracy: Shall be better than ±0.05%
Reference junction compensator		○		0°C±0.2°C
Thermocouple for test		○		Same type of thermocouple as input type
Standard variable resistor			○	Accuracy: Shall be better than ±0.05%
3-core copper wire			○	Three lead wires shall have the same resistance value.

2) Connections

Connections depend upon the input types. See the next page.

3) Before starting check

①Mount the terminal board cover and turn on the power supply.

②Warm up the instrument for longer than 30 minutes until it is stabilized before starting check.

(It is recommended to warm up the instrument for longer than one hour.)

Remarks Check

Checking and adjustment of measuring values work require careful work with a standard tool and other tools employed under the reference conditions.

For asking us for the checking and adjustment of measuring values, please contact our sales agent.

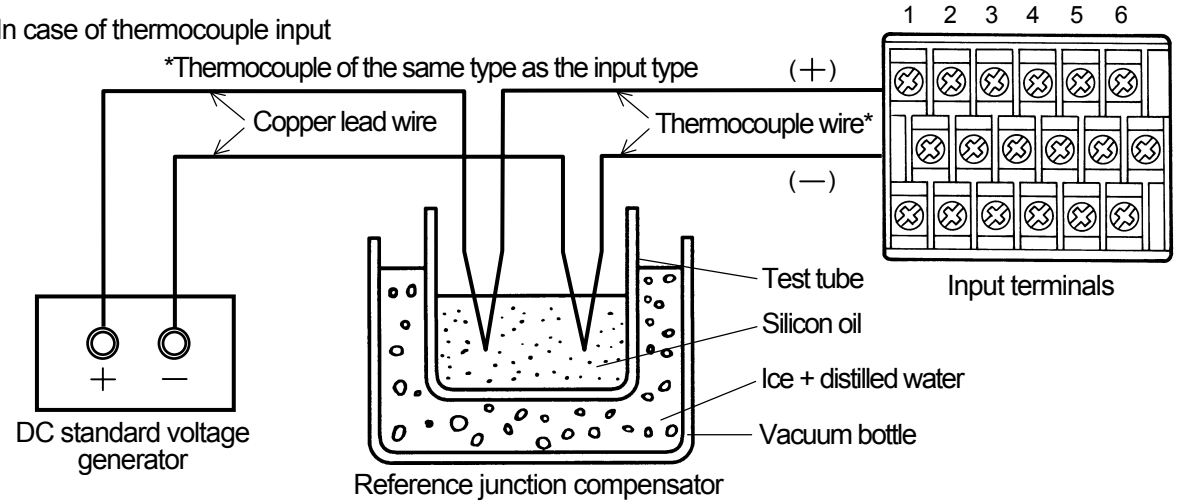
3. Connections

Connections depend upon the input types.
Connect a standard tool and other tools to the measuring input terminals to be adjusted.

Caution Turn off the source power supply before starting connections

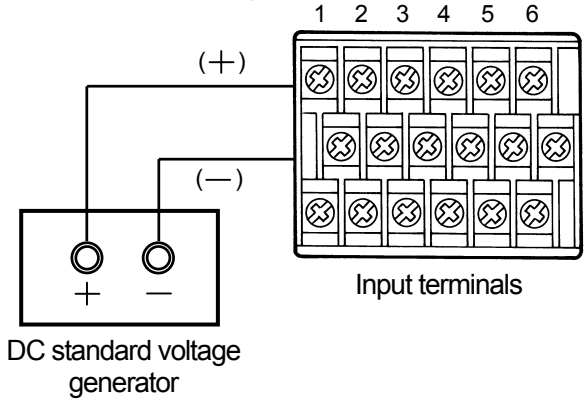
Turn off the source power supply before starting connections for the purpose of preventing an electric shock accident.

①In case of thermocouple input

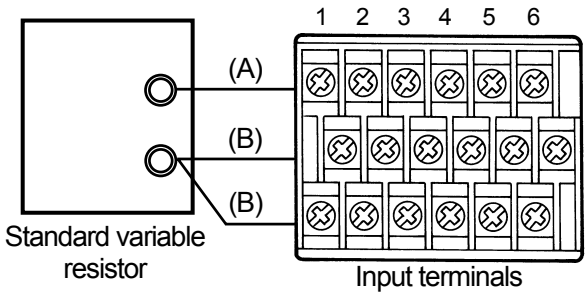


The electromotive force of the thermocouple input becomes small by the electromotive force equivalent to the temperature at terminals. The instrument itself compensates for the electromotive force equivalent to the temperature at terminals. This is called reference junction compensation. Accordingly, the reference junction compensator is necessary for reducing the electromotive force compensated.

②In case of DC voltage input



③In case of resistance thermometer input



4. Checking method

Give an input (T) corresponding to 0%, 50%, and 100% of the printing range from a standard tool and obtain an error (e) by reading measured values (M).

How to obtain an error

$$e(\%)= \frac{M-T}{T} \times 100$$

19.4. Troubleshooting ⚠

Troubleshooting methods are shown by symptoms. Read corresponding symptom items.

Warning Repair and modifications

Never repair or modify the instrument by replacing assembled component units or parts, otherwise correct repair or modifications cannot be executed and also an electric shock accident or the damage of the instrument may occur.

1. Not working

Check	Causes and remedial measures
1) Check if power is supplied to power terminals.	Turn on the external source power supply.
2) Check if the power supply is as specified.	Feed power supply as specified (100 to 240 VAC 50/60Hz).
3) Check if connections to power terminals are correct.	Connect the cable to power terminals (L,N) correctly.
4) Try turning off and on the external source power supply.	
5) Initialize the programmed values and check if the instrument is recovered to normal conditions. See par.18.1. (Caution) All programmed values become the default values. Program them again.	

2. Measured values

Symptoms	Causes and remedial measures
1) Measured values are unstable.	・Check measuring terminals for looseness. ・Check if the input signal is unstable. ・Check if the thermocouple is connected with another instrument in parallel and the burnout function is programmed to [enabled].
2) Check if measured value is displayed as shown below. −−−−− bUrn	・Check if input terminals are connected correctly. ・Check input terminals for looseness. ・Check if input signal wires are disconnected. ・Check if the input signal exceeds the measuring range.
3) An error occurs	・Check if °C/°F operation selection is correct. ・Check if the input signal is correct. ・Check if extension wire is connected to input terminals. (Thermocouple input only) ・Check the scale and adjust measured values, if an error is detected. (Par. 16. 1)
4) Influences by ambient temperature (Thermocouple input only)	・Check if RJ selection is 0 (disabled) in [range/printing range] programming. (This is negligible if reference junction compensation is executed externally.) ・Check if the terminal cover is mounted.

3. Abnormal Displays

Symptoms	Causes and remedial measures
1) CH number remains stopped. *1	One-point continuous display ⇨ See par.6.4.1.
2) Measured values blink *2	Measured value blink in alarm-on channel. ⇨ See par.10.4.2.
3) Measured values are blank. *2	Measured values are blank in skipped channels.
4) Year/month.day/hour. minute are displayed. *2	An operation screen ⇨ See par. 6.4.2.

*1: In case of multi-point sequential display *2: In case of multi-point simultaneous display

4. Printing

Symptoms	Causes and remedial measures
1) No printing is executed.	・Check if printing is turned off. ⇨ See par. 6.2. ・Check if cassette ribbon is mounted normally.
2) Digital printing is not executed.	No digital printing is executed if the chart speed is programmed to be faster than 251 mm/h. ⇨ See par. 10.2.
3) Printing color is thin.	Replace cassette ribbon.
4) Chart feed is abnormal.	・Check if chart is unlatched from the sprocket. ・Check if chart cassette is securely inserted into the internal unit. ・Check if chart has been shuffled before loading it.

5. Other troubles

Symptoms	Causes and remedial measures
1) Keys are not acceptable.	Keys are locked. Unlock them. ⇨ See par. 11.12.
2) Programmed value cannot be changed.	
3) Programmed values remain unchanged after changing them.	Programmed values are not stored into memory without pressing [SHIFT] + [SET END] keys when the values are programmed every channel. ⇨ See programming in par. 8.2 and others.

Request

If a trouble cannot be recovered by the above troubleshooting, certain parts may be defective.
Confirm the following items and ask your sales agent.
①Model ②Serial No. ③Troubles ④Other detected symptoms

19.5 Recommended Parts Replacement Intervals ⚠

It is recommended to replace parts periodically as preventive maintenance for using the instrument under good conditions for a long time.

Warning Replacement of parts

Don't replace any parts other than consumable chart and cassette ribbon, otherwise the instrument cannot be recovered correctly and a dangerous accident may also occur. Ask our sales agent for replacing parts.

1. Working conditions

The reference parts exchange intervals are under the following standard conditions.
The intervals become shorter if the ambient conditions are worse than the standard conditions.

Items	Conditions
Temperature	20 to 50 °C
Humidity	20 to 80 %RH
Working time	8 hours / day
Corrosive gas	Shall be free of corrosive gases

Items	Conditions
Others	①A place free of dust, moisture, and soot ②A place free of vibrations and shocks ③A place where operation is not affected unfavorably

2. Reference parts exchange intervals

Part names			Exchange reference	Remarks
Mechanical components	Printer		4 to 6 years	
	Drive cord		4 to 6 years	
	Chart drive mechanism		6 to 8 years	
	Cassette ribbon drive mechanism		6 to 8 years	
	Ribbon select mechanism		6 to 8 years	
	Various motors		4 to 6 years	
Electrical components	Power supply unit		5 years	Ambient temperature 25 °C
	Display board		4 to 6 years	
	Sheet switch (key)		4 to 6 years	
	Relay (for input selection)		5 years	Narrow span of resistance thermometer input: 2 years
	Relay	(Mechanical relay for alarm output)	70,000 times	Resistive load (Less than rated contact capacity)
			20,000 times	Inductive load (Less than rated contact capacity)
	EEPROM		7 years	Rewrite count About 100,000 times or less
	Lithium battery		7 years	

20. SPECIFICATIONS

1. INPUT SPECIFICATIONS

Number of measuring points: 6 points, 12 points or 24 points

Input signals: DC voltage……...…..±13.8mV, ±27.6mV, ±69.0mV, ±200mV, ±500mV, ±2V, ±5V, ±10V, ±20V, ±50V

DC current……...…....Available by adding shunt resistors (option)

Thermocouples……B, R, S, K, E, J, T, N, NiMo-Ni, CR-AuFe, PtRh40-PtRh20, WRe5-WRe26, W-WRe26, Platinel Ⅱ, U, L

Resistance thermometer…….Pt100 (IEC751 1997), Ptl00 (IEC751 1989), JPt100, Pt50, Pt-Co

Range : Program range number and printing range for each channel.

Measuring range : Refer to the table of range numbers in par. 8-2.

Minimum printing ranges : Refer to the following table according to resolution.

DC voltage	More than 1/5 of the measuring range	
Thermocouple	More than 2/5 of the measuring range when converted into electromotive force (In case that the range numbers with minus measuring ranges, the temperature higher than 0 °C is specified as the lower-limit measuring value.)	
Resistance thermometer	Pt100	More than 100 °C span
	Pt50	More than 200°C span

Accuracy rating : Refer to Item 6. (at reference operating condition)

Temperature drift : ±0.01% of full scale/°C

Measuring cycle : About 5 seconds/6-point or 10 seconds / 12 points, 20 seconds / 24 points

Reference junction compensation accuracy :K, E, J, T, N, Platinel Ⅱ…….Maximum ±0.5°C

R, S, NiMo-Ni, CR-AuFe, WRe5-WRe26, W-WRe26, U, L …….Maximum ±1.0°C

Except B, PR20-40

Burnout : For thermocouple inputs and resistance thermometer inputs

Up-scale burnout, down-scale burnout or burnout disabled is selectable for each input.

Input resistance : Thermocouple input…….About 8MΩ

DC voltage input (Range of less than ±2V)…….About 8 MΩ

DC voltage input (Range of more than ±5V)……About 1 MΩ

Allowable signal source resistance: DC voltage inputs, thermocouple inputs ..... Maximum 1kΩ (burnout disabled)

Resistance thermometer inputs ..... Maximum 10Ω per wire

Maximum input voltage:

DC voltage, Thermocouple	Less than ±10 VDC (Range of less than ±2 V) Less than ±60 VDC (Range of more than ±5 V)
Resistance thermometer	Less than ±6VDC

Maximum common mode voltage : 30VAC

Common mode rejection ratio : Minimum 130dB (50/60Hz)

Series mode rejection ratio : Minimum 50dB (50/60Hz)

Terminal board : Terminal blocks of measuring inputs and alarm output (optional alarm output only) are detachable and removable on wiring

2. PRINTING SPECIFICATIONS

Printing interval : About 5 seconds/point
Printing dead band : 0.1%
Printing system : Wire-dot type 6- color ribbon on trace and digital printings
Print/color : Trace printing (dot)….. ① ⑦ ⑬ ⑲…….Red
② ⑧ ⑭ ⑳…….Black
③ ⑨ ⑮ ㉑…….Blue
④ ⑩ ⑯ ㉒…….Green
⑤ ⑪ ⑰ ㉓…….Brown
⑥ ⑫ ⑱ ㉔…….Purple
Digital printings…...Periodic data printing, digital data printing, fixed-time printing: Repetition of red, black, blue, green, brown and purple
Alarm printing.....Red
Programming change mark……Black
List printing: Programmed parameters…Same colors as trace printing, Others……Black
Channel number printing…Same colors as trace printing
Chart : Fan-fold type, 180mm effective width
Total width: 200mm, total length: 20 m
Chart speed : 1 to 1500mm/h
Periodic data printing : Digital printing of time, channel numbers and measured values on trace printing (Interval time is programmed optionally.)
Digital data printing : Digital printing of time, channel numbers and measured values by interrupting trace printing on demand
Alarm printing : Alarm on……...Time, channel number, alarm type and level in right side of chart
Alarm-reset…..Time, channel number and level in right side of chart
Programming change mark : Mark in right side of chart whenever parameters are changed and stored.
List printing : Printing of programmed parameters by interrupting trace printing on demand
Fixed-time printing : Printing of year/month・day/time, time line, chart speed, scale, engineering units and tags every fixed-time
Skip function : No display or printing of channels being stored as clear on programming [range/printing range]
Subtract printing : Printing of difference of between reference channels or between reference channel and reference

3. DISPLAY SPECIFICATIONS

Digital display : See the following table.

Display	Segment	Number of digits	Character height
Multi-point sequential (VFD)	16	1	11 mm
	7	15	7 mm
Multi-point simultaneous (LCD)	16	1	8 mm
	7	30,60 *	6 mm

* 60 digits in case of 12-point and 24-point inputs

Display items : Multi-point sequential display…….Display of channel, measured value, chart speed, and time. For measured values, one-point continuous display is selectable.
Multi-point simultaneous display….Either simultaneous display of measured values of all channels * of display of clock, channel speed, and alarm status is selectable.
*For 24-point input, two groups of 12-point are displayed selectively.

Programming display : Digital display is shared by key operation.
Status and error displaly : See the following table.

Multi-point sequential display	Multi-point simultaneous display
·PRINT ·ALARM CH. 123….12 ·KEY LOCK ·RECORD ON	·ALARM ·KEY LOCK ·RECORD ON
·S.E ·F.E } Status part	·Set Error ·For Error } Digital display

Display range : -9999 to + 99999
Decimal point : Multi-point sequential display…….Lower significant 3 digits or less
Multi-point simultaneous display…(Upper LCD)…Lower significant 2 digits or less
(Lower LCD)…Optional

4. ALARM SPECIFICATIONS

Alarm point : Channel numbers × levels (4)
Alarm types : Select from the following six types for each alarm point.

Absolute value	H: Higher-limit	L: Lower-limit
Change-of-ratio *1	U: Increase-limit	d: Decrease-limit
Differential *2	B: Differential higher-limit	S: Differential lower-limit

*1: Variation range per unit time (Note)
(Note) Measuring cycle × measuring count (1 to 9)
*2: Difference between two channel

Alarm deadband : 0.1 to 9.9% of scale programming range
Alarm-on display :①Status (ALARM) illuminates.
②Flushing measured value of alarm-on channel
(Multi-point sequential or 1-point continuous display)
③Display of alarm-on channel (0,1)
(Time or other display)
Alarm printing : Refer to 2. printing specifications

5. GENERAL SPECIFICATIONS

Rated power voltage : 100 to 240 VAC, 50/60Hz (universal input)
Power consumption : Maximum 45VA
Environmental conditions :

Items		Reference operation	Normal operation	
Ambient temperature		21 to 25°C	0 to 3l°C	31 to 40°C*
Maximum ambient humidity		80%RH	80%RH	80 to 50%RH*
Minimum ambient humidity		20%RH	20%RH	
Power voltage		100VAC±1%	90 to 264 VAC	
Power frequency		50/60Hz±0.5%	50/60Hz±2%	
Attitude	Left/right	0°	0 to 10°	
	Forward tilting	0°	0°	
	Backward tilting	0°	0 to 30°	
Warm-up time		Longer than 30 minutes	Not required	

*This value decreases linearly down to 50%RH at 40°C from 80%RH at 31°C.

Transportation conditions : Ambient temperature/humidity range……-20 to +60°C ,
5 to 90%RH (No dew condensation)
Vibrations…..10 to 60Hz, less than 0.5G
Impact……Less than 40G
(At the packed condition on shipment from our factory)

Storage conditions : -20 to +60°C , 5 to 90%RH (No dew condensation)
Power failure protection : Programmed parameters stored into EEPROM memory.
Clock circuit sustained for minimum 10 years by a lithium battery.

Insulation resistance:

Primary and protective conductor terminals..... More than 20MΩ at 500 VDC
Secondary and protective conductor terminals ..... More than 20MΩ at 500 VDC
Primary and secondary terminals..... More than 20MΩ at 500VDC

Dielectric strength:

Primary and protective conductor terminals..... 1 minute at 1500VAC
Secondary and protective conductor terminals ..... 1 minute at 500 VAC
Primary and secondary terminals..... 1 minute at 2300VAC
Alarm terminals (Mechanical relay) and other secondary terminals..... 1 minute at 1000VAC
(Note) Primary terminals : Power terminals (L,N), Alarm output terminals (MOS relay)
Secondary terminals : Measuring input terminals, Remote contacts terminals, Communications interface terminals

Clock accuracy : Within ±2 minutes per 30-day
(Except errors by turning power supply on or off under reference operating conditions)
Case assembly material..: Door : Frame ..... ABS resin
Enclosure..... Steel
Color : Door : ……Frame : Black (equivalent to Munsell N3.0)
Enclosure : Gray (equivalent to Munsell N7.0)
Mounting : Panel mounting
Weight : Approx 9.0 kg (full option equivalent)
External dimensions : 288(H) × 288(W) × 220(236)(D)mm
Parenthesized values shows the depth when communications interface or alarm + remote contacts is added.
Panel cutout : 281 × 281mm
Safety standards : Refer to page 0-4.
Terminal screws : Power, Protective conductor terminals.....M4.0
Other terminals.....M3.5

6. Accuracy Ratings

No.	Input type	Measuring range	Reference range	Accuracy rating
01	DC (mV)	-13.80 to 13.80mV	±13.8mV	±0.1%±1d
02		-27.60 to 27.60mV	±27.6mV	
03		-69.00 to 69.00mV	±69.0mV	
04		-200.0 to 200.0mV	±200.0mV	
05		-500.0 to 500.0mV	±500.0mV	
06	DC (V)	-2.00 to 2.00V	±2V	
07		-5.00 to 5.00V	±5V	
08		-10.00 to 10.00V	±10V	
09		-20.00 to 20.00V	±20V	
10		-50.00 to 50.00V	±50V	
21	K	-200.0 to 300.0°C	±13.8mV	±0.1%±1d
22		-200.0 to 600.0°C	±27.6mV	
23		-200 to 1370 °C	±69.0mV	
24	E	-200.0 to 200.0°C	±13.8mV	
25		-200.0 to 350.0°C	±27.6mV	
26		-200 to 900°C	±69.0mV	
27	J	-200.0 to 250.0°C	±13.8mV	
28		-200.0 to 500.0°C	±27.6mV	
29		-200 to 1200 °C	±69.0mV	
30	T	-200.0 to 250.0°C	±13.8mV	
31		-200.0 to 400.0°C	±27.6mV	
32	R	0 to 1200 °C	±13.8mV	
33		0 to 1760 °C	±27.6mV	
34	S	0 to 1300 °C	±13.8mV	
35		0 to 1760 °C	±27.6mV	
36	B	0 to 1820 °C	±13.8mV	
37	N	-200.0 to 400.0°C	±13.8mV	±0.15%±1d
38		-200.0 to 750.0°C	±27.6mV	
39		-200 to 1300 °C	±69.0mV	
40	W -WRe26	0 to 2315 °C	±69.0mV	

No.	Input type	Measuring range	Reference range	Accuracy rating
41	WRe5 -WRe26	0 to 2315 °C	±69.0mV	±0.2%±1d
43	PtRh40 -PtRh20	0 to 1888 °C	±13.8mV	
44	NiMo-Ni	-50.0 to 290.0°C	±13.8mV	
45		-50.0 to 600.0°C	±27.6mV	
46		-50 to 1310 °C	±69.0mV	
47	CR-AuFe	0.0 to 280.0K	±13.8mV	
48	Platinel II	0.0 to 350.0°C	±13.8mV	±0.15%±1d
49		0.0 to 650.0°C	±27.6mV	
50		0 to 1395 °C	±69.0mV	
51	U	-200.0 to 250.0°C	±13.8mV	
52		-200.0 to 500.0°C	±27.6mV	
53		-200.0 to 600.0°C	±69.0mV	
54	L	-200.0 to 250.0°C	±13.8mV	±0.1%±1d
55		-200.0 to 500.0°C	±27.6mV	
56		-200 to 900.0°C	±69.0mV	
70	Pt100 (JIS'97)	-140.0 to 150.0°C	160Ω	±0.15%±1d
71		-200.0 to 300.0°C	220Ω	±0.1%±1d
72		-200.0 to 850.0°C	400Ω	
73	Pt100 (QPt100 JIS'89)	-140.0 to 150.0°C	160Ω	±0.15%±1d
74		-200.0 to 300.0°C	220Ω	±0.1%±1d
75		-200.0 to 649.0°C	400Ω	
76	JPt100	-140.0 to 150.0°C	160Ω	±0.15%±1d
77		-200.0 to 300.0°C	220Ω	±0.1%±1d
78		-200.0 to 649.0°C	400Ω	
79	Pt50	-200.0 to 649.0°C	220Ω	±0.1%±1d
80	Pt-Co	4.0 to 374.0K	220Ω	±0.15%±1d

Note) " ±1 d" at accuracy rating stands for ±1 digit

Note) Thermocouple inputs do not include reference junction compensation accuracy.

The Indication equivalent to 200 μV may vary under the test environment of EMC directive.

Exceptions to accuracy rating

Input type	Measuring range	Accuracy rating
K,E,J,T,L	-200 to 0°C	±0.2%±1digit
R,S	0 to 400°C	
B	0 to 400°C	Not specified
	400 to 800°C	±0.15%±1digit
N,U	-200 to 0°C	±0.3%±1digit
W-WRe26	0 to 100°C	±4%±1digit
	100 to 300°C	±0.5%±1digit
PtRh40-PtRh20	0 to 300°C	±1.5%±1digit
	300 to 800°C	±0.8%±1digit
CR-AuFe	0 to 20K	±0.5%±1digit
	20 to 50K	±0.3%±1digit
Pt100('97)	700 to 850°C	±0.15%±1digit
Pt-Co	4 to 50K	±0.3%±1digit

Note) Thermocouple input is converted into the reference range.

7. Option specifications

Options		Explanations
Measuring interval		About 1 sec/6-point, 2sec/12-point, 4sec/24-point conforms to CE marking. Indications equivalent to about 25°C or 2mV may fluctuate in the test environment demanded by EMC command.
Remote contacts*		By using 4-point contact inputs, the following operation is executed. Selection of 3-chart-speed/printing off, digital data printing, list printing
Alarm output*		Alarm point : 6-point, 12 or 24 points (OR output possible) Capacity: ·MOS relay output 240 V (AC/DC), 50 mA (AC/DC) ·Mechanical relay output ('a' and 'c' contacts common) 100 VAC, 0.5 A and 240 VAC, 0.2 A, 100 VDC, 0.3 A, Any of them at the time of resistance load (Note) For the mechanical relay 'c' contact output, the international safety standards do not conform
Recording format	Automatic range shift printing	Printing range is automatically changed into a new range in the event of overrange or underrange.
	Compressed/ expanded printing	A part of printing area of each channel is printing compressed or expanded.
	Zone printing	Printing area is divided into 2 to 4 zones.
High-speed trace printing		Printing intervals…About 2.5 seconds/point
Communication interface		3 kinds of RS-232C, RS-422A, RS-485 (to be specified). Separate instruction manual is attached.
Shunt resistor		Measurement of current up to ±50mA by adding shunt-resistors to input terminals is possible.
Mathematical function		Each mathematical function of (1) addition, subtraction, multiplication and division, (2) extraction of the square root, (3) logarithms, (4) exponents, (5) maximum, minimum and average, and (6) temperature and humidity
Totaliser		Totalising of measuring data and/or mathematical function result data

* The depth becomes longer by 16 mm in the external dimensions.
Only the mechanical relay 'a' contact output becomes longer by 27 mm.

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